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Distributions of Stonefly (Plecoptera) and Caddisfly (Trichoptera) Species in Three Stream Systems in New Brunswick and Nova Scotia, Canada, with Reference to Stream Acidity

R. H. Peterson and L. van Eeckhaute

Biological Station,
St. Andrews, N.B. E0G 2X0

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DISTRIBUTIONS OF STONEFLY (PLECOPTERA) AND CADDISFLY (TRICHOPTERA) SPECIES IN THREE STREAM SYSTEMS IN NEW BRUNSWICK AND NOVA SCOTIA, CANADA, WITH REFERENCE TO STREAM ACIDITY

R. H. Peterson and L. van Eeckhaute
Aquaculture and Invertebrate Fisheries Division
Department of Fisheries and Oceans
Biological Station
St. Andrews, New Brunswick E0G 2X0

Erratum: p. 9, No. 24. Pteronarcidae. Second sentence should read: "None had a prominently notched mesonotum."

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ABSTRACT

Peterson, R. H., and L. van Eeckhaute. 1990. Distributions of stonefly (Plecoptera) and caddisfly (Trichoptera) species in three stream systems in New Brunswick and Nova Scotia, Canada, with reference to stream acidity. Can. Tech. Rep. Fish. Aquat. Sci. 1720: iii + 42 p.

Fifty-seven sites on three Maritime stream systems (Saint Croix, N.B., Medway and Gold, N.S.) were systematically sampled for invertebrates. Approximately 30 and 100 plecopteran and trichopteran taxa, respectively, were identified. Collection of *Leuctra truncata, Isoperla holochlora, Culoptila cantha, Hydropsyche betteni, H. scalaris, H. alternans, Hydroptila xoncla* (?), *H. hamata, Oxyethira grisea, Palaeagapetus celsus, Ceraclea annulicornis* (?), *C. diluta* (?), *C. resurgens* (?), *Oecetis persimilis, Triaenodes injusta, Glossosoma nigrior, Nyctiophylax celta, Rhyacophila carolina, R. manistee*, and *Brachycentrus numerosus* represent probable extension of known ranges for these species.

Taxa common to the Saint Croix system but uncommon in the acidic Nova Scotian systems were *Phasganophora capitata, Acroneuria* spp., *Paragnetina media, Agapteus* spp., and *Hydropsyche morosa*. Taxa present in the Saint Croix system but not collected from the Nova Scotian systems included *Isoperla holochlora, Paragnetina immarginata, Pteronarcys biloba, Micrasema charonis, Hydropsyche scalaris, H. alhedra, Macrostemum zebratum*, and *Neophylax fuscus*. *Perlesta placida* was collected more commonly in the Nova Scotian systems. Taxa collected in the Nova Scotian systems but not in the Saint Croix included *Ostrocerca albidipennis, Leuctra sibley*, and *Hydroptila acadia* (?).

The distributions of the various taxa are discussed in terms of stream acidity and possible geographic influence.

RÉSUMÉ

Peterson, R. H., and L. van Eeckhaute. 1990. Distributions of stonefly (Plecoptera) and caddisfly (Trichoptera) species in three stream systems in New Brunswick and Nova Scotia, Canada, with reference to stream acidity. Can. Tech. Rep. Fish. Aquat. Sci. 1720: iii + 42 p.

Cinquante-sept sites dans trois réseaux fluviatiles (Sainte-Croix (N.-B.) Medway et Gold (N.-É.)) des provinces Maritimes ont été systématiquement soumis à des échantillons pour en recenser les populations d'invertébrés. Environ 30 taxons de plécoptères et 100 taxons de trichoptères ont été identifiés. La cueillette de *Leuctra truncata, Isoperla holochlora, Culoptila cantha, Hydropsyche betteni, H. scalaris, H. alternana, Hydroptila xoncla* (?), *H. hamata, Oxyethira grisea, Palaeagapetus celsus, Ceraclea annulicornis* (?), *C. diluta* (?), *C. resurgens* (?), *Oecetis persimilis, Triaenodes injusta, Glossosoma nigrior, Nyctiophylax celta, Rhyacophilia carolina, R. manistee* et *Brachycentrus numerosus* représente une extension probable des aires de distribution connues de ces espèces.

Les taxons que l'on retrouve communément dans le réseau fluviatile de la Sainte-Croix, mais qui sont peu communs dans les réseaux fluviatiles de la Nouvelle-Écosse sont: *Phasganophora capitata, Acroneuria* spp., *Paragnetina media, Agapteus* spp., et *Hydropsyche morosa*. Parmi les taxons présents dans le réseau fluviatile mais qui n'ont pas été recueillis dans les réseaux de la Nouvelle-Écosse, notons *Isoperla holochlora, Paragnetina immarginata, Pteronarcys biloba, Micrasema charonis, Hydropsyche scalaris, H. alhedra, Macrostemum sebratum* et *Neophylax fuscus*. L'espèce *Perlesta placida* a été recueillie plus souvent dans les réseaux néo-écossais. Au nombre des taxons recueillis dans les réseaux de la Nouvelle-Écosse mais non dans la Sainte-Croix figuraient *Ostrocerca albidipennis, Leuctra sibley* et *Hydroptila acadia* (?).

Le rapport traite de la distribution des divers taxons en fonction de l'acidité des cours d'eau et des influences géographiques éventuelles.

INTRODUCTION

The Maritime provinces are characterized by stream systems exhibiting a wide diversity of chemical characteristics. Streams in southwestern Nova Scotia are characterized generally by high concentrations of dissolved organic matter and low pH, while those in southwestern New Brunswick are usually of circum-neutral pH, and often have a lower dissolved organic carbon (DOC) concentration. Several other parameters of stream chemistry may be correlated with DOC and/or pH, such as dissolved calcium, magnesium, aluminum, and iron.

For the last 3 yr, we have been studying the distributions of fish, mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddis flies (Trichoptera) in three stream drainage systems: 1) St. Croix R. system, draining southwestern New Brunswick and emptying into Passamaquoddy Bay (Fig. 1, 2); 2) the Gold R. system, draining an area south of the Kentville-Wolfville axis into the south shore of Nova Scotia (Fig. 1, 3); and 3) the Medway R. system, draining a section of southwest Nova Scotia to the west of the Gold R. - roughly parallel to the latter system, but separated from it by the LaHave drainage (Fig. 1, 4).

This report presents an annotated list of the stoneflies and caddis flies identified from the above stream systems. For several genera, it has not been possible to assign species names, and some other species identifications are tentative. With some caddis flies, the genus Hydroptila in particular, the collection of metamorphotypes (mature pupae and larval sclerites retained in the pupal sac) permitted association of larvae with previously identified adults.

In this paper, we have used the term "stream" in a general sense to denote a lotic body of water. We will use the term "large" river to refer to streams which are large enough to have practically no canopy (base flow discharges of 1 m^3/s or greater). Small to medium rivers have varying degrees of partial canopy (.01-1 m^3/s discharge). Brooks are streams small enough to be totally canopied (.001-.01 m^3/s), but usually do not dry completely. Rivulets are intermittent streams (less than .001 m^3/s), usually spring fed.

This report will provide background documentation for future quantitative reports. Voucher specimens representative of each taxon listed here have been preserved in ethanol and are available.

STUDY SITES AND COLLECTING METHODS

Twenty-three (numbered 1-25) sites were sampled on the St. Croix system (Fig. 1, 2), 21 sites (31-52) on the Medway (Fig. 1, 2) and 13 (72-84) on the Gold (Fig. 1, 3). We attempted to sample a sufficient number of sites so that replication for various parameters, such as stream size, would build some duplication of habitat type into the study (App. I).

Rocky riffle areas only were sampled with standard Surber samplers at all sites with substrate size ranging from gravel to large boulder, so that species associated with pools would be poorly represented in our collections. Three samples were collected at each site at each of five sampling periods spaced regularly from early May until late October-early November. During each sampling period at each site, one sample was taken from substrate containing periphytic vegetation, if present, and one taken near the stream margin. By systematic temporal sampling through the open water season, and by selecting heterogeneous substrates within the rocky riffle habitat, we hoped to maximize the probability of collecting all or most of the species inhabiting this habitat.

Adults were also netted when available during the benthic sampling and, for some species, mature larvae or nymphs were reared in the laboratory to obtain adults for species verification.

The references and keys used to identify various taxonomic groups will be given in the sections dealing with these specific groups.

I. PLECOPTERA

Nemouridae

The nymphs of the family Nemouridae were identified with the use of the keys in Harper and Hynes (1971a). Mature nymphs are required for most species, and the requirement of intact cerci for identification of some species was occasionally a problem. The adults were

Fig. 1. A map of New Brunswick and Nova Scotia with the approximate drainage areas of the three stream systems outlined with dashed lines. 1. St. Croix drainage system; 2. Kentville, N.S.; 3. Wolfville, N.S.; 4. Gold R. drainage system; 5. Medway R. drainage system; 6. St. Andrews, N.B.

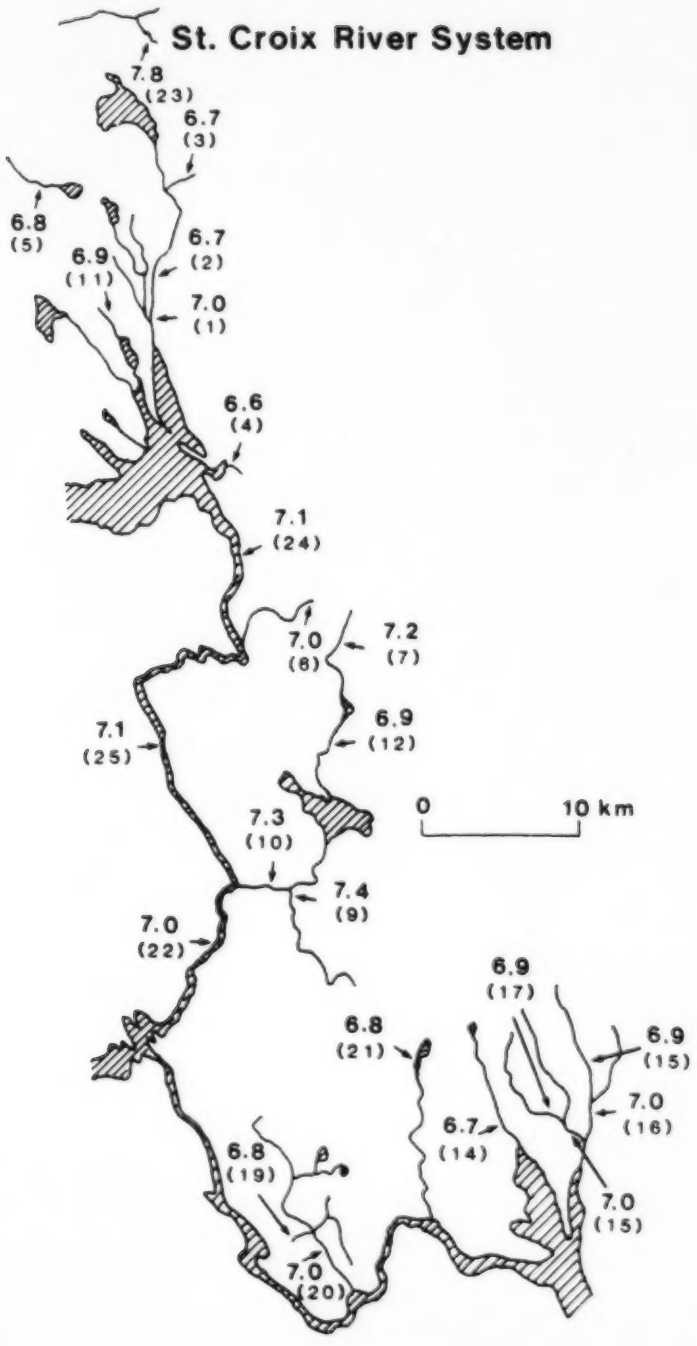

Fig. 2. A map of the St. Croix R. drainage system with locations of various study sites indicated by arrows. The site numbers are given in parentheses, and a representative mid-summer pH level is given for each site.

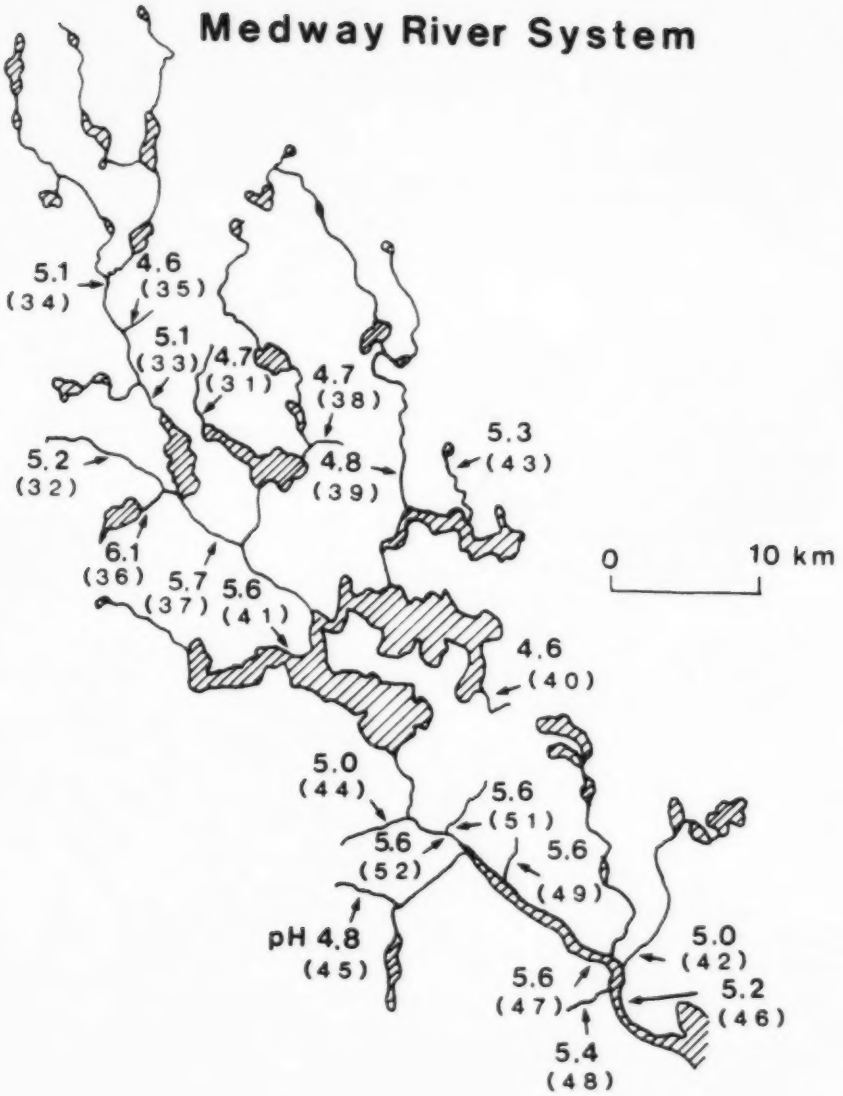

Fig. 3. A map of Medway R. drainage system. Study sites (numbers in parentheses) indicated by arrows. Representative mid-summer pH levels are shown for each site.

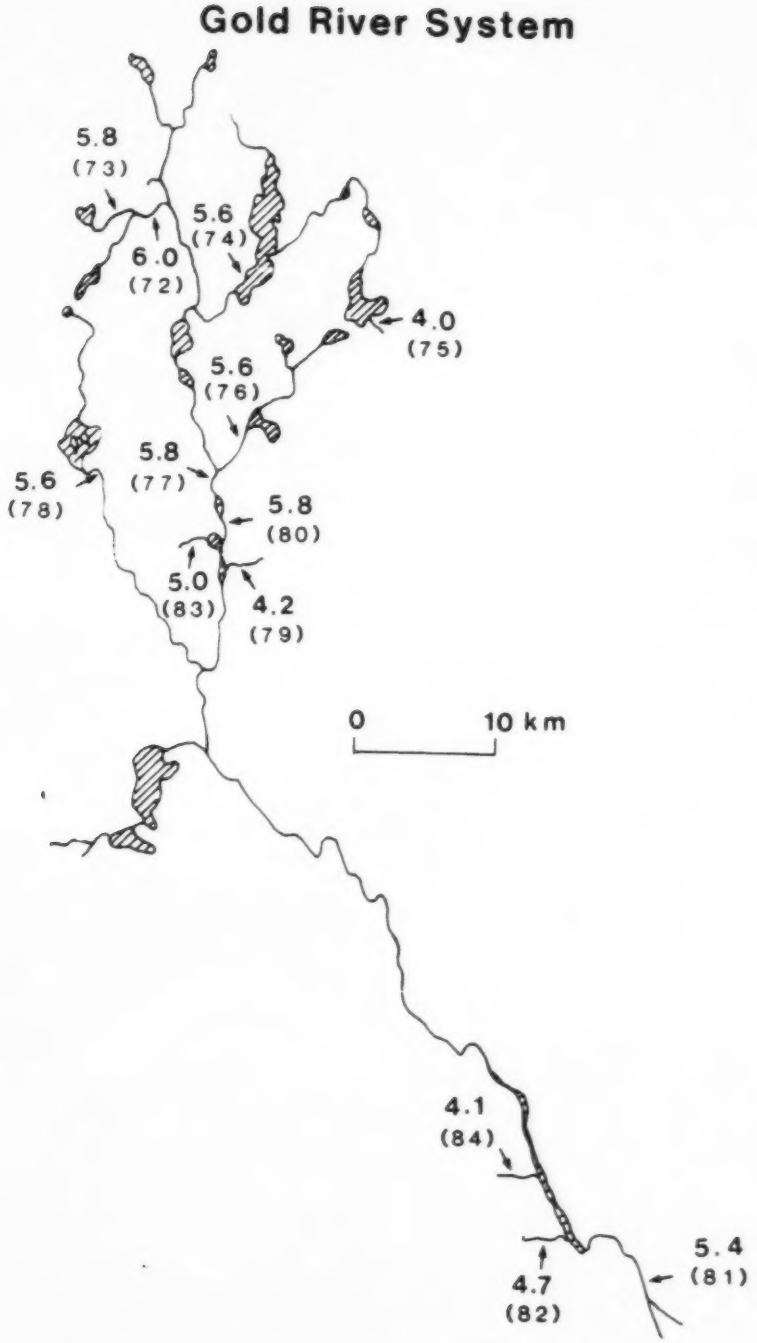

Fig. 4. A map of Gold R. drainage system. Study sites (numbers in parentheses) indicated by arrows. Representative mid-summer pH levels are shown for each site.

identified from keys provided in Hitchcock (1974).

1. *Nemoura (Amphinemura) wui* Claassen

This species and the next have much the same life history and are found at similar sites, being most abundant in small, cold brooks. We have, however, collected this species in small numbers in the main stem of the Gold R. Immature nymphs were collected in May, and mature nymphs and adults mainly in July. Adults of this species have been identified from sites 6, 31 and 83. *A. wui* is apparently very acid tolerant.

Collected at sites: 3, 6, 17, 19, 31, 35, 44, 75, 78, 80, 81, 83.

2. *Nemoura (Amphinemura) nigritta* Provancher

A. nigritta differs from *A. wui* as described in Harper and Hynes (1970). The marginal setation on the pronotum is not reliable, using a dissecting microscope, unless both species are present for comparison. The arrangement of pro-notal gill filaments is more reliable. *A. nigritta* is somewhat more widely distributed than *A. wui* in all three stream systems, and the two species co-inhabited many sites. The life histories of the two species appear similar. Adult males of *A. nigritta* have been identified from sites 16 and 46.

Collected at sites: 3, 6, 11, 14, 16, 19, 35, 38, 40, 42, 43, 45, 46, 47, 48, 49, 51, 52, 73, 75, 77, 79, 82, 83, 84.

3. *Nemoura trispinosa* (?) Claassen

This species was tentatively identified only from one site, a small spring-fed, intermittent rivulet of the Gold R. The nearly mature nymphs were collected in June.

Collected at site: 84.

4. *Nemoura (Podmosta) macdunnoughi* (?) Ricker

Specimens which key out to this species (Harper and Hynes, 1971a) were collected in small numbers from several medium sized brooks. The number of tibial hairs was quite variable, with most specimens having numerous hairs. The rest of the characteristics matched well. The nymphs of this species appear to mature earlier than the Amphinemura species - early to mid-May.

Collected at sites: 16, 18, 32, 36, 42, 51, 82.

5. *Nemoura spp.*

Two male nymphs were collected, one from the Medway R., the other from the Larder R., in early May with genitalial protruberances most resembling those for *N. rotunda* and *N. completa*, respectively, as illustrated in Harper and Hynes (1971a). Cerci were lacking for the first specimen, and some other details were uncertain, so that positive identification could not be made. Similarly no positive conclusion could be drawn regarding the identification of the second specimen.

Collected at sites: 33, 78.

6. *Nemoura (Ostrocerca) albidipennis* Walker

Mature male nymphs of *O. albidipennis* were easily recognized by the characteristic genital protruberance (Harper and Hynes, 1971a). *O. albidipennis* was collected in rivulets and small brooks in the two Nova Scotian stream systems, but was not collected from the St. Croix drainage.

Collected at sites: 46, 48, 49, 73, 79, 83, 84.

Leuctridae

Leuctridae nymphs were identified with the use of the key and descriptions of Harper and Hynes (1971b). Series of nymphs, rather than single specimens were utilized where possible. Adults were identified using the keys in Hitchcock (1974). All Leuctridae were similar in regard to colour pattern (at least when preserved), with no distinguishing markings present.

7. *Leuctra tenuis* (Pictet)

Leuctra tenuis was generally distributed in rivers and larger brooks of the three stream systems. The number of setae covering the 9th sternite was quite variable. Mature nymphs were collected from July through September. Adult males of this species were identified from sites 2, 5, 10, 12, 16, 17, and 77.

Collected at sites: 1, 2, 5, 9, 10, 12, 16, 17, 20, 21, 23, 25, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 48, 49, 51, 52, 73, 74, 77, 78, 80, 82, 83.

8. *Leuctra ferruginea* (Walker)

As reported in Harper and Hynes (1971) *L. ferruginea* was sampled mostly from small, cool brooks and rivulets. Adult males of this species were collected from sites 38 and 45 in mid-June, and from site 6 in early July.

Collected at sites: 3, 6, 11, 35, 38, 40, 41, 42, 44, 45, 46, 48, 49, 51, 73, 75, 79, 82, 83, 84.

9. *Leuctra sibleyi* Claassen

Leuctra sibleyi is one of the more distinctive members of the genus by virtue of the bushy whorls of setae at the base of each cercal articulation (Harper and Hynes, 1971b). The shafts of the cercae also appear to be more robust when compared to those of other *Leuctra spp.* nymphs of equal size. *Leuctra sibleyi* was collected from only 2 sites. Several late instar nymphs were collected in early May, and some early instar nymphs in October at site 42 - a largish brook. Only the early instars in October were collected at the other site, on the main stem of the Gold R.

Collected at sites: 42, 77.

10. *Leuctra truncata* Claassen (?)

Nymphs of *Leuctra truncata* and the next species, *L. tenella* are very similar, differing mainly in the number of setae at the antero-lateral corner of the mesonotum (Harper and Hynes 1971b). The distributions among our study sites agree with the statements in Harper and Hynes (1971b) that they are primarily found in cool brooks. Adults of *L. truncata* were collected at site 14 on August 7.

Collected at sites: 14, 15, 18, 19, 39, 42, 44, 45, 82, 83.

11. *Leuctra tenella* Provancher (?)

As stated in the section dealing with *L. truncata* these two species were very similar, and occupy similar habitats. Neither were collected as frequently as *L. tenuis* or *L. ferruginea*. It was not always possible to distinguish them with certainty on the basis of mesonotal bristles.

Collected at sites: 35, 38, 39, 44, 45, 49, 51, 73, 76, 78, 82, 83.

12. *Leuctra duplicata* Claassen (?)

Four nymphs were collected from site 84, a spring-fed rivulet, in early May, which keyed out to *Leuctra duplicata*, based on the distinctive setation on the anterior margin of the pronotum.

Collected at site: 84

13. *Leuctra sp.*

A series of morphologically aberrant nymphs was collected at site 46 in early May which lacked compound eyes or had only a few ommatidia. They may have been aberrant *L. ferruginea* as this species was collected at this site in small numbers. The setation on the abdomens of the aberrant specimens was variable, not conclusive taxonomically.

Perlodidae

Species in this family were identified with the aid of keys presented in Hitchcock (1974).

14. *Isoperla transmarina* (Newman) (?)

Isoperla transmarina was most frequently collected from rivers, although it was collected from a couple of the larger brooks as well. Its distribution overlapped that of *I. frisoni* considerably. Nymphs of *I. transmarina* appear to mature about a month earlier than those of *I. frisoni* when both were found at the same site. Immature *Isoperla* nymphs, which were probably of these two species, were collected from several sites in October. *Isoperla transmarina* could be easily told from nymphs of the other two species collected by the color pattern on the head capsule. The light spot within the ocellar triangle was much smaller in *I. transmarina* than in the other two species. An adult *I. transmarina* was reared from a nymph collected at site 11; however, we had difficulty placing many adult *Isoperla* to species with the key in Hitchcock (1974). We consider all species identifications in this genus to be tentative.

Collected at sites: 11, 14, 22, 24, 25, 33, 34, 38, 52, 77, 80.

15. *Isoperla frisoni* Illies (?)

Isoperla frisoni collections indicated a distribution that overlapped with that of *I. transmarina*; however, its distribution appeared to be biased toward somewhat smaller streams. Mature nymphs occur in mid- to late June. It was collected at more sites in the Medway system than in either the Gold or St. Croix systems.

Collected at sites: 2, 33, 34, 36, 37, 41, 42, 49, 74, 76.

16. *Isoperla holochlora* (Klapalek) (?)

Isoperla holochlora had a distribution quite unlike that of the previous two species. It was found only in the St. Croix drainage system, and was collected only from brooks and smaller rivers. Hitchcock (1974) does not include the Maritimes within its range. The head capsule of *I. holochlora* is characterized by a broad median stripe extending from the antero-medial ocellus to the anterior margin of the head capsule.

Collected at sites: 1, 11, 14, 17.

Perlidae

17. *Neoperla* sp.

The genus *Neoperla* was thought to have only one Nearctic species, *clymene* (Newman) until Stark and Baumann (1978) split it into eight species based upon adult characteristics. Which species inhabits the Maritimes is unknown. The nymphs of the genus were characterized by the presence of only 2 ocelli and the distance of the eyes from the posterior corner of the head. *Neoperla* sp. was collected only from large, main stem river sites in the St. Croix and Gold drainage systems. In fact, *Neoperla* sp. seemed more restricted to large rivers than the other large Perlidae collected in this study. Its absence from downstream sites on the main stem of the Medway R. may indicate intolerance to low pH.

Collected at sites: 24, 25, 80, 81.

18. *Phasganophora capitata* (Pictet)

Nymphs of *P. capitata* were distinguished from those of other Perlidae by the presence of a row of spinules across the back of the head on an occipital ridge, the presence of sub-anal gills and the brightly patterned thorax and abdomen (Hitchcock, 1974). *Phasganophora capitata* was widely distributed in the St. Croix system, being collected from several brooks as well as rivers. It was collected rarely or not at all at sites below lake outfalls. As with *Neoperla* sp., *P. capitata* was not collected from the Medway system and only from two main stem sites on the Gold system.

Collected at sites: 9, 10, 14, 15, 16, 17, 18, 23, 24, 25, 77, 81.

19. *Perlesta placida* (Hagen)

Perlesta placida was easily recognized by its occipital ridge, subanal gills and freckles on the abdomen and appendages (Hitchcock, 1974; Frison, 1942). In the St. Croix system, *P. placida* was mainly confined to sites below lake outfalls. In the Medway and Gold systems it was much more widespread, occurring in several of the larger brooks as well as the main Medway.

Collected at sites: 4, 21, 24, 25, 33, 37, 38, 39, 41, 42, 44, 47, 52, 76, 81, 82.

20. *Acroneuria lycorias* (Newman)

Acroneuria lycorias is one of several large Perlidae inhabiting the study streams. It was distinguished from the others by virtue of the lack of an occipital ridge and transverse row of occipital setae, presence of anal gills, a conspicuous light "W" mark on the anterior head capsule, and contrastingly dark posterior margins on the abdominal segments (Hitchcock, 1974). *Acroneuria lycorias* was more widely distributed through the St. Croix system than in the two Nova Scotian drainage systems where it was collected only from sites on the main stem rivers.

Collected at sites: 1, 4, 5, 10, 12, 16, 17, 18, 19, 20, 22, 23, 24, 25, 33, 39, 47, 52, 77, 81.

21. *Acroneuria abnormis* (Newman)

Acroneuria abnormis can be distinguished from *A. lycorias* by the absence of anal gills and abdominal segments of a uniform mahogany brown color. *Acroneuria abnormis* was collected from more sites in all 3 stream systems than was *A. lycorias*; although they were collected together at many sites.

Collected at sites: 1, 2, 5, 9, 10, 12, 14, 15, 16, 18, 19, 20, 21, 22, 23, 25, 33, 34, 37, 42, 76, 77, 80, 81.

22. *Paragnetina media* (Walker)

The genus *Paragnetina* is distinguished from *Acroneuria* of our area by the presence of a transverse line of occipital spinules and absence of anal gills (Hitchcock, 1974). *Paragnetina media* is characterized by uniformly brown abdominal tergites. The species was collected from many sites in the St. Croix drainage system; although not as many as the two *Acroneuria* species. It was collected from one site each on the Gold and Medway systems - both large river sites.

Collected at sites: 1, 2, 5, 9, 10, 12, 15, 20, 21, 22, 23, 24, 47, 80.

23. *Paragnetina immarginata* (Say)

Paragnetina immarginata differs from *P. media* in the striking banding pattern of the abdominal tergites, as well as well-defined light and dark patterns on the head capsule. The species was collected from only four sites in the St. Croix drainage. An adult male was swept from vegetation at site 25.

Collected at sites: 10, 12, 19, 25.

Pteronarcidae

24. *Pteronarcys (Allonarcys) biloba* Newman (?)

The collected nymphs of this genus all keyed to the species *biloba* from the key provided by Ricker (1952). All had a prominently notched mesonotum. Nymphs were collected from scattered sites in the St. Croix drainage, varying from medium sized brooks to the main stem rivers.

Collected at sites: 1, 14, 17, 18, 24, 25.

25. *Perlinella (drymo)* (Newman) (?)

Immature *Perlinella* nymphs were collected from 3 sites - all medium to large rivers. Although immature, the anterior ocellus was visible in most of them, so it was concluded that they were *P. drymo* (Kondratieff et. al., 1958).

Collected at sites: 24, 25, 39.

Chloroperlidae

26. *Alloperla spp.*

Alloperla species were distinguished by lack of gills, a folded anal lobe on the hind wing - reflected in a notched or siniate hind wing pad in the nymph -, and the shape of the maxillary palp (Hitchcock, 1974). Nymphs cannot be identified to species at present. Specimens of this genus were collected at many sites in the St. Croix drainage, but at only 2 sites each on the Gold and Medway drainages. A series of adults, collected at site 16 (Waweig R.), was identified as *A. marginata (Banks)* - as was a male from site 2, while an adult female collected at site 77 (Gold R.) keyed to the banks-caudata-concolor group (Hitchcock, 1974: note an error in the first couplet of Hitchcock's key, the second line of couplet 1 should lead to couplet 7 - not 6). An adult female lab-reared from site 25 keyed to *A. mediana* Banks.

Collected at sites: 12, 13, 4, 5, 9, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 44, 51, 77, 83.

27. *Isogenus sp.*

Nymphs of *Isogenus* may be separated from those of other Perlodidae (Hitchcock 1974) by the presence of sub-mental gills (subgenus Hydroperla) and abdominal tergites that frequently are transversely banded. Small numbers of *Isogenus* nymphs were collected occasionally from a few sites in the St. Croix drainage system. They could not be identified to species.

Collected at sites: 9, 12, 14, 25.

Taeniopterygidae

Most of the Taeniopteryx nymphs collected for this study were too immature to key to species. A more mature nymph collected from

Pout Bk. in mid-November was keyed using Harper and Hynes (1971c). Adults were identified with keys in Hitchcock (1974) - modified from Ricker and Ross (1968).

28. *Taeniopteryx spp.*

Nymphs of this genus were collected from many sites in October and early November. At this time they were too immature to key to species. One nearly mature nymph collected from Pout Bk. (site 17) later in November was identified as *T. burksi* Ricker and Ross. Adults of *T. burksi* were also reared in the lab from nymphs collected at sites 17 and 18. *Taeniopteryx* nymphs were collected from sites in the Medway drainage system more frequently than in the other two drainage systems.

Collected at sites: 1, 2, 9, 10, 12, 15, 16, 17, 18, 20, 22, 23, 31, 32, 33, 34, 35, 37, 38, 39, 41, 42, 43, 45, 46, 47, 48, 49, 51, 52, 74, 76, 77, 78, 80, 81, 82, 83.

29. *Brachyptera (Strophopteryx) fasciata* (Burmeister)

Brachyptera nymphs were not collected during the study period; however, some nymphs were collected from site 18 in February, from which an adult female was reared and later keyed to this species.

Capniidae

The immature nymphs of the Capniidae often collected during this study were not readily identified; Harper and Hynes (1971d) have published a key for identification of some Capniidae nymphs to species. Hitchcock (1974) was used to key the few adults available.

30. *Paracapnia spp.*

Paracapnia was the most frequently encountered genus of the family, being collected as early as July at many Medway and Gold R. sites. Conversely, no nymphs were collected from any of the St. Croix sites during the regular sampling. Some mature nymphs were collected from some of these sites in February and March, and an adult male was reared in the lab from a mature nymph collected at site 18 in February. This specimen was identified as *P. angulata* Hansen. Some mature nymphs also keying to *P. angulata* were collected from site 18 in February. Other nymphs, collected from the Waweig R. (near site 16) in March resembled the description of *Paracapnia opis* (Newman) most closely - as did a half-grown nymph from site 83 in October. As both species are reportedly common in the Maritimes, the immature nymphs collected at many sites probably include both species. The genus is apparently quite acid tolerant, but was not collected from the smallest rivulets.

Collected at sites: 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44, 45, 47, 48, 49, 51, 52, 75, 76, 77, 78, 79, 80, 81, 82, 83.

31. *Allocapnia spp.*

This genus was collected at only three sites (one on the Medway system, two on the Gold system) during regular sampling. Some mature nymphs and adults were collected by additional sampling at some St. Croix sites from February to April. An adult male, collected at site 21 on 13.IV.86, keyed to *A. pygmaea* (Burmeister) based on the form of the epiproct. The 8th tergal process, however, displayed a notch most resembling, that of *A. aurora* Ricker - a southern form. As some characteristics can show considerable variability (Hitchcock 1974) we believe the specimen fits the description of *A. pygmaea* best. Another adult male collected at site 18, on 9.III.87 keyed to *A. maria* Hanson - a reportedly common Maritime species (Hitchcock 1974). In addition, a series of mature nymphs collected at site 18 on 23.II.87 were keyed to *A. pygmaea* on the basis of the long supraanal lobe; but these could have been *A. maria* as well, since the nymphs of this species are not described. Some smaller nymphs, possibly *A. minima* (Newport) were taken in the same sample. Obviously no generalizations can be made on the probable distributions of this genus based on May to October sampling as the nymphs are most effectively sampled in late winter.

Collected at sites: 51, 73, 83.

II. TRICHOPTERA

Brachycentridae

Larvae of the genus Brachycentrus were identified from the keys provided by Flint (1984). The family is characterized by presence of sclerotized plates on the pro- and mesonota, but not the metanotum; the lack of humps on abdominal segment 1, and the construction of

portable cases (Wiggins, 1977). Chapin (1978) provides a key for the larvae of *Micrasema* species.

1. *Brachycentrus (Sphinctogaster) appalachia* Flint

The larvae of *B. appalachia* have a strikingly banded head capsule. The mid- and hind-tibiae have only one baso-mesal seta as compared with 3-5 for *B. numerosus* - another species identified in this study. Life history details for *B. appalachia* are given in Peterson and Martin-Robichaud (1986) and Peterson et al. (1987) for populations in the Westfield R., N. S. Adults and pupae were found in May. *B. appalachia* inhabits rivers, usually being absent from sites at lake outfalls. It is apparently quite pH tolerant. An adult male of this species was collected from site 1 and male pupae from sites 1 and 39.

Collected at sites: 1, 2, 9, 10, 12, 16, 20, 22, 25, 37, 39, 51, 52, 76, 77, 78, 80, 81.

2. *Brachycentrus (Sphinctogaster) numerosus* (Say)

Three larvae of *B. numerosus* were collected in mid-August at site 22, the largest river sampled. This species has not previously been noted from the Maritime provinces. It differs from *B. appalachia* as given in the description for the latter species.

Collected at site: 22.

3. *Micrasema charonis* Banks

Micrasema charonis has a smooth, tapered case of circular cross-section, formed from vegetable fragments. The head capsule is usually brown with no distinctive pattern and the abdomen is green in fresh specimens. Our life history data (unpublished) indicate that *M. charonis* adults occur in June-July. Early larval instars were collected in late July - early August. The species overwinters as partly grown larvae. As indicated by Chapin (1978) it was associated with moss. Unlike Chapin's (1978) observations for the Pennsylvania-South Carolina area, *M. charonis* was not confined to the coldest streams. It was usually taken from larger brooks. Adults of *M. charonis* were collected from sites 15 and 18. It was collected only from the St. Croix drainage system. Schmid (1983) documented its occurrence in N.B. and N.S.

Collected at sites: 4, 14, 15, 17, 18, 23.

4. *Micrasema wataga* Ross

Micrasema wataga was a common and abundant species in all three drainage systems. It was found at almost all sites except those on small, cool brooks. It has a tapered case similar to that of *M. charonis*, but differs from the latter species in having the brown head capsule mottled with darker brown. *M. wataga* has an extremely wide distribution throughout North America (Schmid 1983). Unlike *M. charonis*, which has one distinct cohort annually, a wide range of instars of *M. wataga* are usually present. Pupae were collected from June to October. The species is either multivoltine or univoltine with much asynchrony. Adult males of *M. wataga* were collected from sites 20 and 25, and male pupae from site 10.

Collected at sites: 1, 2, 5, 9, 10, 12, 14, 19, 20, 21, 22, 24, 25, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 47, 48, 49, 51, 52, 74, 75, 76, 77, 78, 80, 81, 83.

5. *Micrasema sprulesi* Ross

Micrasema sprulesi differs from the two previous species, *M. charonis* and *M. wataga*, by having a single seta at the sa1 position on the meso-notal plates (Chapin, 1978). As stated by Chapin (1978), *M. sprulesi* inhabits cool brooks. An adult female was reared from a larva of this species collected at site 11, emerging May 16.

Collected at sites: 11, 15, 17, 73.

Glossosomatidae

Members of this family are easily recognized by the characteristic tortoise shell-shaped case. The larvae of the family are characterized (Wiggins 1977) by little or no sclerotization of the mesonotum, a dorsal sclerotized plate on abdominal segment 1X, and an anal proleg broadly joined to segment 1X.

6. *Agapetus spp.*

Agapetus larvae are characterized by two fairly large mesonotal sclerites, and lack of a sclerotized line bordering the anal opening

(Wiggins 1977). *Agapetus* larvae could not be identified to species; however, mature pupae were identifiable and were collected at many sites. Two species were identified from pupae, *A. pinatus* Ross and *A. rossi* Denning, both of which have previously been identified from the Maritime provinces (Schmid 1982). Adults of *A. pinatus* were collected from site 2, and those of *A. rossi* from sites 16, 18 and 25. The two species co-inhabited several sites. The genus was common in the St. Croix drainage system, but was taken from only one site in Nova Scotia.

Collected from sites: (*Agapetus* larvae) 1, 2, 5, 9, 10, 14, 15, 16, 17, 18, 22, 23, 81.
(*A. pinatus* pupae or adults) 1, 2, 14, 15, 16, 17, 18, 23.
(*A. rossi* pupae or adults) 10, 16, 17, 18, 81.

7. *Culoptila cantha* Ross

Culoptila larvae were collected from two sites on the main St. Croix, supporting Wiggins (1977) suggestion that it occurs in large river habitats. Although the larvae could not be identified, adult males and females of this species were collected at site 25, and we assume that the larvae collected were also of this species. The genus has not previously been reported from the Maritimes, but *C. cantha* has been identified from Maine (Schmid 1982).

Collected at sites: 22, 25.

8. *Glossosoma nigrior* Banks

Glossosoma nigrior is widely distributed in all three stream systems in a wide range of stream sizes. It was usually absent from the smallest brooks, and below lake outfalls. While the larvae cannot be identified to species, mature pupae, which can be identified (Schmid 1982), were collected from almost all sites. Adults were also collected at most sites. *Glossosoma nigrior* is extremely widespread and common from Newfoundland to Minnesota. In Peterson and Martin-Robichaud (1986) the Glossosoma larvae were tentatively identified as *G. lividum*. They were undoubtedly *G. nigrior*.

Collected at sites: (Larvae) 1, 2, 5, 7, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 22, 23, 25, 34, 36, 38, 41, 44, 45, 51, 76, 77, 81, 82, 83. (Pupae) 1, 2, 5, 6, 9, 10, 11, 12, 14, 15, 17, 19, 22, 23, 25, 34, 36, 37, 44, 76, 77, 81, 83. (Adults) 1, 2, 11, 15, 16.

9. *Protoptila sp.*

Protoptila sp. was collected from larger, warmer rivers, as was *Culoptila cantha*, and in agreement with Wiggins' (1977) observations on habitat restriction. Two adult females and one adult male were collected from site 25. Positive identification as to species could not be made. The male keyed to either *P. palina* Ross or *P. lega* in Ross' (1944) key. The latter species had been identified from New Brunswick (Schmid 1982). Schmid (1982) does not include *P. palina* among the species discussed and the male in our collection appeared to fall closer to *P. maculata* Hagen in Schmid's descriptions. The female genitalia matched either *P. palina* (c.f. Ross) or *P. lega* (c.f. Schmid) - the drawings for the two species are virtually identical.

Collected at sites: 22, 25, 41.

Helicopsychidae

10. *Helicopsyche borealis* (Hagen)

Helicopsyche borealis larvae are easily recognized by the snail-like spiral case made of sand grains. The species was widespread in small to large rivers, but was absent from brooks. Adults of both sexes were collected from site 10 in late July and from site 16 in late June. Although larvae were collected throughout the summer, pupae were collected only in July as well, so that it would appear that adults emerged in July-August. *H. borealis* was widespread in all three stream systems.

Collected at sites: 1, 2, 4, 5, 10, 12, 15, 16, 20, 22, 23, 24, 25, 34, 36, 37, 41, 42, 47, 49, 52, 74, 76, 77, 78, 80, 81.

Hydropsychidae

11. *Parapsyche apicalis* (Banks)

Parapsyche apicalis was easily distinguished by its large rectangular ventral apotome separating the genae and by the abdominal scale tufts containing 6-8 scales each (Flint 1961). In agreement with Flint's observation that this species is found only in small spring-fed brooklets, we collected *P. apicalis* only at site 3; a cold, spring-fed rivulet.

Flint listed Nova Scotia as within its known range; however, we collected none in the Gold and Medway systems.

Collected at site: 3.

12. *Diplectrona modesta* Banks

The genus *Diplectrona* is characterized by having the ventral apotome divided into anterior and posterior plates, with the genae contiguous between (Wiggins 1977), the posterior apotome being about 1/2 the length of the ecdysial line separating the genae. *Diplectrona modesta* is the only species known to occur in eastern Canada, so we tentatively identified our specimens as that species. Our identification is supported by an adult male of this species collected at site 31 in mid-June. *D. modesta* was present in cool brooks of all three stream systems.

Collected at sites: 6, 14, 31, 38, 40, 44, 45, 48, 49, 51, 75, 82, 83.

13. *Cheumatopsyche spp.*

There are no keys available to identify larvae of *Cheumatopsyche* to species. The genus as a whole was widely distributed in all three stream systems, but usually absent from the smaller brooks. Adults and mature pupae of several species were collected. A species identified as *C. sordida* (Hagen) (site 37 (15.VI); site 48 (16.VI); and site 52 (16.VI)) was common in the Medway system. *C. campyla* Ross was identified from sites 25 (early VII), 24 (10.VI) and 74 (5.VII) - those from site 25 identified by F. Schmid. Several other species were tentatively identified: *C. pettiti* (Banks) from sites 16 (8-14.VII) and 21 (7.VI) and *C. pasella* Ross from sites 21 (7.VIII), 24 (25.VI) and 74 (17.VI). Two other groups of mature pupae keyed nearest to species whose known ranges are midwestern and further collecting is required: some from site 4 (20.VIII), apparently most closely resembled *C. lasia* Ross; and some from sites 72 (29.VIII) and 21 (26.V, 15.VII) were apparently closest to *C. rossi* Gordon - a species known only from the type locality in Arkansas.

Collected at sites: 1, 2, 4, 5, 6, 9, 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 32, 33, 34, 36, 37, 39, 40, 41, 45, 47, 48, 49, 52, 72, 73, 74, 76, 77, 78, 80, 81, 83.

14. *Hydropsyche betteni* Ross

Hydropsyche betteni larvae characteristically have dark brown head capsules with a yellowish area surrounding the eye (Schuster and Etnier, 1978). It and *H. sparna* were the two most abundant and widely distributed of the genus in our study. *Hydropsyche betteni* is reportedly one of the most adaptable members of the family, having larvae very tolerant of organic pollution (Schuster and Etnier 1978). It was collected at almost all sites, except the smallest brooks and rivulets. Some details of the life history in a Nova Scotian stream are given in Peterson et al. (1987). Mature pupae were collected from many sites, so that genitalic characteristics could be used to support the larval identifications.

Collected at sites: 1, 2, 4, 5, 6, 7, 9, 11, 12, 15, 16, 17, 18, 19, 20, 21, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 43, 44, 45, 47, 48, 49, 51, 52, 72, 73, 74, 75, 76, 77, 80, 81, 82, 83.

15. *Hydropsyche scalaris* Hagen

Hydropsyche scalaris was collected only from large, warm rivers in the St. Croix system, being most abundant below lake outfalls. The larvae are larger than those of most other species and are fully described in Schuster and Etnier (1978) who do not include the Maritimes within its known distribution. The head capsule is tan with darker brown mottlings. Brown pigment patches occur on the genae halfway between the compound eye and the posterior margin. The frontoclypeus is brown with tan spotting. The nota are tan with black lateral and posterior margins, and the abdomen is light purplish. Several adults (both sexes) were collected at site 24 in addition to mature pupae. As with most Hydropsychidae, the adults appeared to have a long flight period - adults were collected from June to September.

Collected at sites: 4, 20, 22, 24.

16. *Hydropsyche morosa* (Hagen)

Hydropsyche morosa is one of a number of "checkerboard" species whose frontoclypeus has a checkerboard pattern of white or yellowish spots on a black background. *Hydropsyche morosa* may be frequently distinguished from the other species by the presence of an additional three small distinct spots in the

posterior angle of the frontoclypeus (Schuster and Etnier 1978). However, some *H. morosa* have other spot patterns as well. Schefter and Wiggins (1986) have characterized *H. morosa* larvae on the basis of setal characteristics. *Hydropsyche morosa* was apparently much more widely distributed in the St. Croix system than in the two Nova Scotian stream systems. In the St. Croix it was widespread from larger brooks to the main stem river. In the Medway and Gold systems it was taken only in the main stem.

Collected at sites: 1, 2, 4, 5, 9, 10, 12, 14, 16, 20, 21, 22, 24, 25, 37, 47, 77.

17. *Hydropsyche alternans* (Walker)

Hydropsyche alternans was identified (Schefter and Wiggins 1986) from two sites in the Saint Croix system; both were on large rivers near lake outfalls. *Hydropsyche scalaris* and *Macrostemum zebratum* were also collected at these sites. The species is not listed in the Maritimes (Schefter and Wiggins 1986). Adults of *H. alternans* were also identified from sites 4 and 24.

Collected at sites: 4, 24.

18. *Hydropsyche bronta* Ross (?)

The species was tentatively identified, on the basis of description and key provided in Schefter and Wiggins (1986), from two sites - both medium to large rivers. The occurrence of reddish spine-like setae on the venter of the anal prolegs was difficult to determine, however, and the identification is considered tentative. The species has not been listed from the Maritimes, but is Appalachian in distribution.

Collected at sites: 1, 81.

19. *Hydropsyche walkeri* Betten and Mosely

This species was identified on the basis of setal characters, described in Schefter and Wiggins (1986) from three sites in the Saint Croix system - all large, warm rivers.

Collected at sites: 10, 12, 22.

20. *Hydropsyche alhedra* Ross

Larvae tentatively identified as *H. alhedra* (P. Schefter, pers. comm.) were collected from several sites in the St. Croix system, where it was fairly common in larger brooks and small rivers. The species is reported from Newfoundland to Alberta (P. Schefter, pers. comm.). The specimens collected in New Brunswick had head capsules somewhat lighter in coloration (dark brown) than described in Schuster and Etnier (1978), but the descriptions of setal distributions are similar to those described for this species (Schefter and Wiggins 1986).

Collected at sites: 1, 5, 9, 14, 15, 16, 17, 18.

21. *Hydropsyche slossonae* (Banks)

The larvae of *H. slossonae* are characterized by a single, large, light spot centrally located on an otherwise dark frontoclypeus (Schuster and Etnier 1978). Occasionally two or three longitudinal spots or a longitudinal pale medial band may replace the single spot. Setal characteristics are provided in Schefter and Wiggins (1986). This species was collected from medium brooks and small rivers in the St. Croix drainage. One adult female tentatively identified as *H. slossonae* was collected from site 16. It is reported widely distributed throughout the northeastern United States and Canada (Schuster and Etnier 1978).

Collected at sites: 11, 14, 15, 16, 17, 18, 23.

22. *Hydropsyche sparna* (Ross)

Hydropsyche sparna and *H. betteni* were the two most abundant and widespread Hydropsychidae in the stream systems studied. Some life history information is given for this species in Nova Scotia (Peterson et al. 1987). The larvae of *H. sparna* were occasionally characterized by the presence of two or three pale spots arranged transversely on the anterior frontoclypeus (Schuster and Etnier 1978). It was the only common *Hydropsyche* collected with a short pronotal seta #22 (Schefter and Wiggins 1986). All of the specimens we collected had three darker pigment spots in the posterior angle of the frontoclypeus. These may be obscured by dark pigment, in which case other characters in the key must be utilized for identification (Schefter and Wiggins 1986). Mature pupae were collected at many sites, and adults of both sexes were identified in a previous study on the Westfield R., N.S. (Peterson et al. 1987).

Collected at sites: 1, 2, 4, 5, 9, 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 47, 48, 49, 51, 52, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83.

23. *Hydropsyche ventura (Ross)*

Hydropsyche ventura is a rare species with a uniformly dark brown frontoclypeus (Schuster and Etnier 1978). We collected some specimens from a cold brook (August-October) which keyed out to this species (Schefter and Wiggins 1986). It had previously been collected in Newfoundland, Ontario and the eastern United States.

Collected at site: 11

24. *Macrostemum zebratum* (Hagen)

Macrostemum zebratum is a large species of Hydropsychidae, easily recognized by the flattened head with u-shaped carina (Wiggins 1977). Adults and larvae agreeing with the description of *M. zebratum* in Ross (1944) were collected. *Macrostemum zebratum* occurs in larger warm water habitats, particularly below lake outfalls. It was not collected from any Nova Scotian sites.

Collected at sites: 4, 20, 21, 22, 24, 25.

Hydroptilidae

25. *Agraylea sp.*

Only two specimens of this genus were collected. A pupa keying to *A. costello* (Ross 1944) was collected from site 20 in September, and an unidentified larva from site 22. Since *A. costello* is the only known North American species occurring in the northeast (Wiggins 1977), it is probable that both specimens are of this species. Since its habitat is in areas of reduced current in large rivers (Wiggins 1977) it was not readily collected during our survey.

Collected at sites: 20, 22.

HYDROPTILA

The genus *Hydroptila* was the most diverse of the various Hydroptilidae sampled. Blickle (1979) provides an adult key and Ross (1944) presents diagrams of larval head capsule patterns of some species. By associating pupal genitalia with larval sclerites retained in the pupal sac, we have tentatively assigned several larvae to species. We have categorized several other specimens on the basis of head capsule pattern, but cannot assign specific names. Identifications were attempted only on 5th-instar larvae.

26. *Hydrotila xoncla* (?) Ross

Larval sclerites associated with mature pupal genitalia keying to *H. xoncla* were available at several sites (e.g. site 38). On the basis of this association, larvae of *H. xoncla* have very dark brown head capsules with numerous orange-yellow muscle scars. In some specimens, the postero-medial muscle scars may fuse to form a yellowish postero-medial band. Several medial scars near a line connecting the posterior margins of the eyes may also fuse to form a larger yellowish spot. The head capsule of *H. xoncla (?)* is also more rounded in lateral view than that of the other species, giving the larvae a more "bull-headed" appearance. The case of *H. xoncla* (?) is distinctive, being triangular and lacking sand grains - composed only of silk and some algal fragments. We collected *H. xoncla* (?) only from cool brooks.

Collected at sites: 17, 31, 38, 44, 45, 48, 82, 83.

27. *Hydroptila acadia* (?) Ross

Larval sclerites associated with mature pupal genitalia of *H. acadia* (?) were collected at several Nova Scotian sites. The larval head capsules and nota are strikingly blackish-spotted on a light yellowish background. *Hydroptila acadia* was fairly widespread in the two Nova Scotian systems, but was not collected from the St. Croix.

Collected at sites: 31, 33, 34, 37, 38, 39, 41, 42, 49, 74, 78, 80, 82.

28. *Hydroptila* sp. 1

Larvae with uniformly dark head capsules and nota were frequently collected. The head capsule was lighter around and anterior to the eyes and along the anterior margin of the head capsule. The pronotum has a light band along the anterior edge. Pupal genitalia keyed to *H. scolops* Ross, which has a northern midwestern distribution, hence positive identification requires

further study. *H.* sp. 1 was common in all three stream systems in a wide range of stream sizes - usually excluded from the smaller brooks. Adults of *H.* sp. 1 were collected at site 16.

Collected at sites: 1, 2, 5, 9, 15, 16, 18, 20, 21, 22, 31, 34, 37, 38, 39, 41, 42, 44, 45, 47, 52, 76, 76, 77, 78, 80.

29. *Hydroptila delineata* (?) Morton

Pupae identified as *H. delineata* were sampled from many Nova Scotian sites. Larvae identified from sclerites associated with these pupae had fuscous brown head capsules with lighter muscle scars more or less clearly defined. Some of the more clearly marked specimens had muscle scars fused to form a postero-medial band and a central lighter spot similar to those described for *H. xoncla* (and *H. albicornis* Hagen as diagrammed in Ross (1944)). The nota were uniform light fuscous brown. *H. delineata* was widespread in the Nova Scotian stream systems, but infrequent in the St. Croix. The cases of *H. delineata* and *H.* sp. 2 are more elongate than those of *H. xoncla* or *H.* sp. 1, and have a covering of sand grains.

Collected at sites: 5, 20, 33, 34, 37, 39, 41, 42, 46, 47, 48, 49, 51, 52, 76, 77, 80, 81, 82, 83.

30. *Hydroptila* sp. 2

Pupae of *H.* sp. 2 were collected from site 21, and larvae have been collected from a few sites in the St. Croix system. Pupal genitalia and head capsule patterns most closely resembled those of *H. grandiosa* Ross; a mid- and southwest species.

Collected at sites: 12, 16, 21, 25.

31. *Hydroptila novicola* (?) Blickle and Morse

Pupae with genitalia keying to *H. novicola* (?) were collected from site 38. The larval head capsule had a medial dark spot between the eyes and a transverse dark band near the posterior margin of the head capsule. The pronotum was similar to that of *H.* sp. 1, but the metanotum had only paired submedial dark patches and a narrow band at the posterior margin. The metanotum had only the posterior band. The case of *H. novicola* was elongate, with no sand grains, and covered with fragments of filamentous algae.

Collected at site: 38.

32. *Hydroptila hamata* (?) Morton

A mature pupa from site 77 was keyed to *H. hamata*, and larvae matching Ross' (1944) description were collected at several sites. The most distinctive marking was a wavy band between the eyes. A transverse pigment band on the posterior head capsule varied considerably in its degree of development among specimens. The pronotum had an anterior pale band and some vague lighter mottling. The meso- and metanota are lightly pigmented, except for narrow dark posterior transverse bands. Two species might be involved since sites 3, 6 and 11 were on small cold brooks, while 22 and 77 were on large rivers.

Collected at sites: 3, 6, 11, 22, 77(p).

33. *Hydroptila spinata* (?) Blickle and Morse

One mature pupa identified as *H. spinata* was collected at site 77. We have no larval associations for this species.

34. *Hydroptila sp. 3*

Several unidentified *Hydroptila* larvae were collected with a light yellow head capsule and a single large dark patch between the eyes. The pronotum had an anterior light band with paired submedial lighter spots. It was found only at site 3, a small spring-fed brook, and site 48 - a small cold brook.

Collected at sites: 3, 48.

35. *Hydroptila sp. 4*

Hydroptila sp. 4 resembled *H.* sp. 1 most closely. The head capsule was similar, although the dorsal pigment may be reduced. The primary differences from *H.* sp. 1 were the lack of pigment on the meso- and metanota, except for the narrow posterior bands, and the case which is longer and relatively narrower than that of *H.* sp. 1. It was covered with sand grains, somewhat more neatly than that of *H.* sp. 1. It may be a variant of *H.* sp. 1 as the two co-occurred at some sites.

Collected at sites: 5, 11, 14, 17, 18, 31, 33, 38, 44, 45.

36. *Hydroptila sp. 5*

A large species with large elongate, sand-covered cases was collected at some sites in the St. Croix system. The most prominent feature was a brown "x" shaped mark on the head capsule. The two anterior prongs of the "x" point to the eyes, while the broader posterior branches extend to the postero-lateral margin of the head capsule and contain some lighter muscle-scar markings. It is possible that this is an extreme variation of *H. hamata* with the wavy line joined to the posterior transverse band to form an "x"; however, the notal patterns are somewhat different as well. It was collected only from larger brooks and rivers in the St. Croix system.

Collected at sites: 1, 9, 10, 25.

37. *Ithytrichia sp.*

The genus *Ithytrichia* is characterized by the dorsal and ventral lobate projections from the abdominal segments, as described in Wiggins (1977). Only one species, *I. clavata* Morton, is known to occur in northeastern North America. A few specimens were collected in the main stem of the St. Croix River.

Collected at sites: 25.

38. *Mayatrichia sp.*

Mayatrichia larvae were characterized by Wiggins (1977). It is probable that all the specimens we collected were *M. ayama* Mosely. Pupae keying to *M. ayama* were collected at sites 10 and 25. *Mayatrichia* larvae were collected mostly from warmer habitats - larger streams and lake outfalls.

Collected at sites: 2, 9, 10, 12, 25, 33, 37, 47, 76, 77, 80.

39. *Neotrichia spp.*

Larvae of *Neotrichia* could not be separated to species. They were collected at a few large stream sites.

Collected at sites: 24, 25, 33.

40. *Oxyethira spp.*

Oxyethira larvae are distinguished from other Hydroptilidae larvae primarily by the long slender legs on the two posterior thoracic segments (Wiggins 1977). The larval case is distinctive as well. Larvae cannot be identified to species. Pupae of several species were tentatively identified: *O. verna* (?) Ross (site 35), *O. grisea* (?) Betten (sites 48, 79, 82), *O. sida* (?) Blickle and Morse (sites 48, 49), *O.* sp. - near *novasota* Ross, a southeastern U.S. species (sites 49, 78) and tentatively *O. mirabilis* Morton (?) (site 79), according to Blickle (1979). *Oxyethira sp.* were widely distributed in all three stream systems.

Collected at sites: 1, 2, 4, 5, 9, 10, 12, 14, 16, 17, 20, 24, 31, 32, 33, 35, 36, 37, 38, 39, 40, 42, 44, 45, 47, 48, 49, 51, 73, 75, 77, 78, 79, 80, 82.

41. *Palaeagapetus celsus* (Ross)

Palaeagapetus larvae are distinguished from other hydroptilid larvae by the curious truncate fleshy tubercles situated laterally on the abdominal segments (Wiggins 1977). Unlike most Hydroptilidae, they were also flattened dorsoventrally. *Palaeagapetus celsus* is the only species of the genus occurring in eastern North America (Wiggins 1977), and pupae collected at site 35 with associated larval sclerites keyed to this species. The species was described by Wiggins (1977) as being confined to montane areas, so it was unusual to find it in southwestern Nova Scotia - an area of rather low relief. Both sites from which it was collected were cool brooks with liverworts present - a preferred association for the species (Wiggins 1977); however, neither could be described as seepage springs - its reported habitat.

Collected at sites: 35, 44.

42. *Stactobiella sp.*

Larvae of *Stactobiella spp.* are characterized in Wiggins (1977). We collected one *Stactobiella* pupa, but could not identify it to species.

Collected at sites: 2.

Lepidostomatidae

43. *Lepidostoma spp.*

Lepidostoma larvae were collected at all but two of the study sites, but at present no keys are available to separate species. Adults keying to *L. costale* (Banks) (P. Schefter, pers. comm.) were collected at site 16 in July and lab-reared from site 11. Pupae identified as *L. griseum* (Banks) (Flint and Wiggins 1961) were collected from sites 35 and 79, and adults of this species were collected from site 75.

Collected at sites: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 45, 46, 47, 48, 49, 51, 52, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84.

Leptoceridae

Ceraclea larvae were keyed using Resh (1976), and pupae collected were identified using Morse (1975). Several species were collected which were apparently not described in Resh's (1976) paper. It should be noted that the larval keys in Resh (1976) may not be appropriate for specimens from the Maritime Provinces. Several species could not be identified, and all I.D.'s must be considered tentative.

44. *Ceraclea* sp. 1

This species of *Ceraclea* was collected from the greatest number of sites. The head capsule was yellow with constrastingly darker spots; antennae were long and parafrontals were present. The species lacked setae on the ninth abdominal segment. Most mature larvae were collected in May or June, usually in large rivers - frequently below lake outfalls. The species most clearly resembled the description of *C. arielles* (Denning) in Resh (1976), a species known only from western North America.

Collected at sites: 2, 4, 21, 24, 42, 52, 78, 80, 81.

45. *Ceraclea annulicornis* (?) (Stephens)

Ceraclea annulicornis (?) had a brown head capsule, parafrontal sclerites, long antennae, and a pair of setae on the ninth abdominal segment. The pronotum was brown with lighter areas laterally (Resh 1976). It had a cornucopia-shaped case of sand grains. *Ceraclea annulicornis* (?) was collected from only site 24 - a large river site below a large lake.

Collected at site: 24.

46. *Ceraclea diluta* (?) (Hagen)

A pupa and several larvae were tentatively identified from site 21, the pupa collected in May. It has a yellow head capsule with no contrasting color pattern, parafrontal sclerites and long antennae. The ninth tergites lack setae (Resh 1976). The case is of sand grains.

Collected at site: 21.

47. *Ceraclea wetzeli* (?) (Ross)

The larvae of *C. wetzeli* were never collected, but a pupa keying to this species (Morse 1975) was collected in late July from the Medway River, N. S.

Collected at site: 33.

48. *Ceraclea tarsipunctata* (?) (Vorhies)

Ceraclea tarsipunctata (?) was a distinctively marked species with contrasting light spots on a glossy brown head capsule. The ninth tergite had two pairs of setae. Parafrontal sclerites were present and the antennae were long (Resh 1976). The relative amounts of plant material and sand grains in the case was variable from site to site.

Collected at sites: 4, 20, 21, 24.

49. *Ceraclea alagma* (Ross) (?)

This species was similar to *C. tarsipunctata* (?), but the frontoclypeus lacked constrasting spots, and is lyre-shaped (Resh 1976). We have tentatively identified a series of larvae from a Gold River tributary as this species.

Collected at site: 72.

50. *Ceraclea* sp. 2

Ceraclea sp. 2 had short antennae, two pairs of setae on the ninth abdominal tegite and a long, sclerotized support bar on the anal legs. The head capsule was brown with contrasting

yellow spotting. We collected this species only on the main stem of the St. Croix River.

Collected at sites: 24, 25.

51. *Ceraclea* sp. 3

This species had a dark brown head capsule with contrasting yellowish spots posteriorly. Parafrontal sclerites were present and the antennae were short. The ninth tergite has two pairs of setae, and the anal legs have an elongate supporting bar. The cases were mainly silk with some sponge spicules and a few sand grains attached. Some specimens we have assigned to this species are tentative as the head capsule was considerably lighter in color.

Collected at sites: 41, 74, 78.

52. *Ceraclea* sp. 4

We have collected no larvae of this species, but two pupae keying nearest to *C. slossonae* (Banks) (Morse 1975) were collected from the main stem of the St. Croix River. As *C. slossonae* is a species of the south-central U.S., species identification was uncertain.

Collected at site: 25.

53. *Ceraclea* sp. 5

This species is one of a group of sponge eating *Ceraclea* lacking parafrontal sclerites. The curved mesonotal bars were less heavily sclerotized anteriorly. The head capsule and pronotum were pale yellow, lacking contrasting color patterns. The gular width was about equal to the length. The case was silken with some sponge spicules attached.

Collected at sites: 9, 24, 41.

54. *Ceraclea resurgens* (?) (Walker)

Ceraclea resurgens (?) differed from *C.* sp. 5 in the shape of the gula, and in the presence of brown spots on the head and pronotum (Resh 1976). The case is entirely of silk.
Collected at sites: 9, 24.

55. *Ceraclea transversa* (?) (Hagen)

This species was similar to the previous two, but had a yellow head with paler yellow spots.

Collected at site: 21.

56. *Ceraclea sp. 6*

This species was unusual in that it clearly lacked parafrontal sclerites, but had long antennae. The mesonotal bars were uniformly sclerotized - unlike the three species of the *alces* group. The case was cornucopia-shaped and had sand grains attached. The head capsule was brown with lighter areas laterally and surrounding the eyes.

Collected at sites: 4, 24.

57. *Ceraclea sp. 7*

This species was similar to *C.* sp. 5, but the mesonotal bars were uniformly sclerotized and uniform brown in color. There were no parafrontals, the antennae were short and the case had a covering of sponge spicules. The head capsule and notal sclerites were pale yellow.

Collected at sites: 32, 37, 47.

58. *Ceraclea sp. 8*

This species was obviously related to the *alces - transversa - resurgens* group in lacking parafrontal sclerites, and having short antennae. As with *Ceraclea* sp. 7, the metanotal bars were uniformly sclerotized and the silken case had sponge spicules attached. The head capsule was reddish-brown.

Collected at sites: 21, 47.

Clearly more work is required on the taxonomy of the species complex lacking parafrontal sclerites to determine the number of species involved.

59. *Mystacides sepulchralis* (Walker)

Although this genus is typical of ponds, lakes and larger rivers, it was collected fairly widely in all three stream systems. In addition, adults were collected at several sites. Spotted larval forms are common which may lead to

misidentification as *M. alafimbriata* Hill-Griffin (Yamamoto and Wiggins 1964) - a species of western North America. Their identity as *M. sepulchralis* was provided by P. Schefter (pers. comm.). Adults only were collected from sites 1, 4, 5, 10, 16 and 52.

Collected at sites: 18, 32, 36, 38, 39, 42, 47, 48, 49, 72, 73, 78.

60. *Oecetis avara* (Banks)

Oecetis avara was identified using keys in Ross (1944) and Smith and Lehmkuhl (1980). The ventral apotome of all specimens we examined placed them into *O. avara*. The species was collected mostly from larger streams and rivers. An adult male was collected at site 24.

Collected at sites: 1, 2, 4, 10, 24, 25, 47, 52, 77, 80.

61. *Oecetis persimilis* (Banks)

Larvae of *O. persimilis* were identified by matching sclerites with a male pupa collected at sites 38, 42 and 78 in late July. The pupal genitalia matched those described for *O. persimilis* by Ross (1944). The larva differed from *O. avara* in having a case composed of wood fragments rather than sand grains. The yellow head capsule was mottled with numerous brown spots, which may partially coalesce, and there is at most a single posterior row of microhooks on the dorsal hump. *Oecetis persimilis* was more widely distributed than *O. avara*, collected frequently in large brooks.

Collected at sites: 1, 5, 15, 20, 21, 31, 32, 33, 34, 36, 37, 38, 39, 41, 42, 47, 49, 51, 52, 72, 74, 76, 77, 78, 80.

62. Oecetis sp. "Y"

A third *Oecetis sp.* was collected which had a brown "Y" mark on the anterior frons, plus brown bars along the frontoclypeus and spots on the posterior part of the head. The case was of sand grains.

Collected at sites: 32, 72.

63. *Setodes sp.*

Specimens of *Setodes* were collected only from the main stem of the St. Croix River. An adult female reared in the lab from a larva collected at site 25 was identified as *S. incerta* (Walker) (Merrill and Wiggins 1971).

Collected at sites: 22, 24, 25.

64. *Triaenodes sp.*

Triaenodes larvae were collected at several sites. Since they typically inhabit macrophytic vegetation, they were probably collected where macrophytes invaded lotic sampling areas. This was particularly true of site 49 where the greatest numbers were sampled. The larva from site 22 keyed to *T. injusta* (Hagen) (Ross 1944) and closely matched the larval description for that species. The others all keyed to *T. tarda* Milne, although the maculation on the head was more regular than that shown in Ross' Fig. 835.

Collected at sites: 12, 20, 22, 24, 36, 42, 49.

Limnephilidae

65. *Apatania sp.*

Larvae of this genus (identified from Wiggins 1977) were collected at several sites, predominantly in the St. Croix system, less often in the two Nova Scotian systems. No descriptions were available to separate species of this genus. Most sites in the St. Croix where the genus was collected are large brooks to large rivers, but the Nova Scotian sites were more heterogeneous - from spring seepages to main stem rivers.

Collected at sites: 1, 2, 9, 10, 11, 15, 16, 18,24, 25, 37, 46, 47, 51, 77.

66. *Frenesia difficilis* (Walker)

Larvae of this species were identified using descriptions provided in Flint (1956). The species was collected from cool brooks in all three stream systems.

Collected at sites: 3, 6, 7, 14, 18, 19, 34, 73, 82.

67. *Glyphopsyche irrorata* Fabricius

Larvae of this genus are distinguished from other Limnephilid genera by the combination of banded tarsae and tibiae, branched gills, and the presence of stout setae on the lateral

sclerite of the anal proleg and anterior edge of the pronotum (Wiggins 1977). *Glyphopsyche irrorata* is the only species of the genus known to occur in eastern Canada. Our species identifications were confirmed from descriptions in Ross (1944). The species was collected at three small brook sites - all in Nova Scotia.

Collected at sites: 43, 72, 73.

68. *Goera spp.*

Larvae of this genus were identified using Wiggins (1977). *Goera fuscula* Banks larvae were identified from sites 15 and 18, based upon the key and descriptions in Flint (1960). The genus was collected in larger brooks and small rivers of the St. Croix system, and was most frequently collected from the Waweig River subdrainage.

Collected at sites: 1, 2, 15, 16, 17, 18.

69. *Hydatophylax/Pycnopsyche spp.*

Difficulty was occasionally experienced in separating these two genera; thus they will be combined here. The genera were mostly collected from brooks, although a few *Pycnopsyche* specimens were found in the main stem of the Gold River. An adult male of *Pycnopsyche guttifer* (Walker) was collected at site 23. In another study, adults of both *P. guttifer* and *P. lepida* Hagen were identified from the Westfield River, N. S., and larvae tentatively assigned to *P. guttifer* on the basis of Flint's (1960) description were collected from sites 23 and 35. Larvae matching Flint's (1960) description of *H. argus* (Harris) were collected at sites 32 and 40.

Collected at sites: 3, 5, 11, 12, 15, 17, 18, 23, 32, 35, 36, 38, 40, 41, 43, 46, 72, 73, 77, 78, 79, 83, 84.

70. *Ironoquia spp.*

Ironoquia larvae are distinguished by having gills with more than four branches and more than two major setae ventrally on the mid- and hind femora (Wiggins 1977). Larvae were collected from two sites on the Medway system, one an intermittent spring seepage, the other a somewhat larger brook.

Collected at sites: 36, 46.

71. *Limnephilus spp.*

Larvae of *Limnephilus* were collected sparingly at six sites in the Medway system - all in either early May or late October. Many species apparently diapause through summer as an adaptation to temporary droughts (Wiggins 1977). A male adult was collected at site 19 keying to *L. hyalinus* Hagen (Ross and Merkley 1952).

Collected at sites: 32, 35, 40, 42, 46, 51.

72. *Nemotaulius hostilis* (Hagen)

A single larva of this species was collected at site 24. As it is not an inhabitant of lotic areas (Wiggins 1977), it probably drifted accidentally into the collecting site, possibly from the lake just upstream of the sampling area.

Collected at site: 24.

73. *Pseudostenophylax sp.*

Three larvae of this genus were collected from site 84, a spring-fed, intermittent road-side trickle. Two species occur in eastern North America (Wiggins 1977), but we did not attempt to identify our larvae as Flint's (1960) larval descriptions were tentative.

Collected at site: 84.

74. *Psychoglypha subborealis* (Banks)

Larvae of this species were collected from several cold brooks spanning all three stream systems. Two of these brooks were among the most acidic habitats sampled. *Psychoglypha subborealis* is the only species of the genus known to occur in eastern Canada (Wiggins 1977). One male pupa was collected (site 75 in late October), and identified to this genus using Denning (1970).

Collected at sites: 11, 19, 35, 75.

Uenoidae

75. *Neophylax oligius* Ross

Neophylax oligius was collected more frequently and in a wider variety of stream sizes than the other *Neophylax* species. *Neophylax oligius* was easily distinguishable from the other *Neophylax* species encountered by the

contrasting pale medial stripe running almost the full length of the frontoclypeus (Flint 1960). Some specimens had noticeable frontoclypeal tubercles. A series of adults of this species (both sexes) was collected from site 2, and pupae with associated larval sclerites were collected from half a dozen other sites. Male genitalia were identified from Ross (1938a).

Collected at sites: 2, 3, 5, 9, 15, 18, 32, 34, 41, 43, 44, 45, 48, 49, 52, 72, 76, 78, 80, 82.

76. *Neophylax concinnus* McLachlan

Neophylax concinnus was collected only from cool brooks. The larvae lacked the thumb-like projections on the first abdominal regiment, a long blade-like seta on the anterior margin of the pronotum and had only a remnant or no median frontoclypeal tubercle (Flint 1960). Our specimens had some light spotting on the posterior half of the frontoclypeus. The dorsal surface of the head was covered with spicules. A series of adults (both sexes) was collected from site 19 and identified from Ross (1944) as *N. autumnus* Vorhies - a synonym of *N. concinnus*.

Collected at sites: 11, 18, 19, 83.

77. *Neophylax fuscus* Banks

This species lacks thumb-like projections on the first abdominal segment and a frontal tubercle, but has long blade-like setae on the anterior margin of the pronotum (Flint 1960). A series of seven adults (both sexes) were collected at site 16, and male genitalia identified from Ross (1938b). It co-occurred with *N. concinnus* and *N. nacatus* in some brooks, but was taken in some larger, warmer streams as well.

Collected at sites: 15, 16, 18, 19.

78. *Neophylax nacatus* Denning

Neophylax nacatus has thumb-like projections on the first abdominal segment and a medial frontoclypeal tubercle (Flint 1960). The heads of our specimens were broader than those of some other species and the posterior semi-circular portion was raised - almost carinate. A male (identified from Denning (1941)) and a probable female were lab-reared from larvae collected at site 19.

Collected at site: 19.

79. *Neophylax aniqua* Ross

This species was collected less frequently than any of the others described above. A male adult was collected at site 11 (identified from Ross (1947)). A probable larva of this species was collected at site 51. The larvae lacked thumb-like projections and blade-like pronotol setae, but had a long frontal tubercle.

Collected at sites: 11, 51.

Molannidae

80. *Molanna spp.*

Molanna larvae principally inhabit areas of slower current with sandy substrate (Wiggins 1977). Larvae were occasionally collected during this study, mostly from smaller brooks which had areas of sandy substrate. An adult male collected at site 1 keyed to *M. ulmerina* Navas (Roy and Harper 1980), and males keying to *M. tryphena* Betten (Ross 1944) were collected at sites 6 and 7. A female keying to *M. ulmerina* Navas (Roy and Harper 1980) was collected at site 75. No attempt was made to identify larvae as a description of *M. ulmerina* was not available.

Collected at sites: 4, 17, 35, 72, 73, 83.

Odontoceridae

81. *Psilotreta indecisa (Walker)*

The larva of P. indecisa (described in Parker and Wiggins (1987)) was readily distinguished from the following species by virtue of its banded black and yellowish head, and by its black legs. *Psilotreta indecisa* was collected from a wider variety of stream types than was *P. frontalis*, and it was encountered less frequently in the two Nova Scotian systems. Pupae were identified to this species (Parker and Wiggins 1987) from several sites, and adult males were collected at site 16 in mid-June.

Collected at sites: 1, 2, 4, 5, 9, 10, 15, 16, 18, 21, 25, 42, 51, 77, 81.

82. *Psilotreta frontalis* Banks

Psilotreta frontalis larvae have been described in Parker and Wiggins 1987). Our specimens were easily distinguished from *P. indecisa* larvae by the yellowish leg color. *Psilotreta frontalis* was collected primarily from cooler brooks of all three stream systems, and was particularly abundant at site 19, a small, cold brook.

Collected at sites: 2, 9, 11, 17, 18, 19, 38, 44, 73.

Philopotamidae

83. *Chimarra aterrima* Hagen

The *Chimarra* species were extremely abundant in the stream systems studied - rivalled in abundance only by some of the Hydropsychidae. Larvae of the three species were identified using keys in Ross (1944) - the distinguishing features being the shapes of the frons and mandibles. Adults were identified according to Schmid (1982) and were readily collected, particularly when swarming on bridges. *Chimarra aterrima* was the most widespread of the three species, being collected from many of the smaller brooks that apparently lacked the other two species. *Chimarra obscura* and *C. socia* tended to be more abundant than *C. aterrima* in large, main-stem rivers and below lake outfalls. The genus was absent from rivulets.

Collected at sites: 1, 2, 5, 9, 10, 11, 12, 15, 16, 17, 19, 20, 21, 22, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 45, 47, 48, 49, 51, 52, 72, 73, 76, 77, 79, 80, 81, 82, 83.

84. *Chimarra obscura* (Walker)

As stated above, this species and *C. socia* were more restricted to larger stream sites. As a preliminary observation, *C. obscura* tended to be prevalent and more abundant below lake outfalls, and *C. socia* dominant in the more downstream stretches of main-stem rivers.

Collected at sites: 2, 4, 10, 16, 20, 21, 22, 24, 25, 31, 33, 34, 36, 37, 41, 47, 49, 52, 72, 73, 74, 76, 77, 78, 80.

85. *Chimarra socia* Hagen

Collected at sites: 2, 4, 9, 10, 20, 22, 24, 25, 31, 32, 33, 34, 35, 37, 39, 41, 47, 51, 52, 77, 80, 81, 83.

86. *Dolophilodes distinctus* (Walker)

This genus is distinguished from other philopotamid genera by the finger-like process of the fore trochantin (Wiggins 1977). Adults were collected from May until mid-November with some collected on snow-covered rocks in several streams - including many wingless females. As compared to the *Chimarra* species, *D. distinctus* was most abundant in the larger brooks and was absent from lake outfall sites.

Collected at sites: 1, 2, 5, 6, 11, 14, 15, 16, 17, 18, 19, 20, 23, 33, 49, 76, 77, 81, 82, 83.

87. *Wormaldia sp.*

Wormaldia may be separated from *Dolophilodes* by the shape of the fore trochantin and head capsule setation (Wiggins 1977). Larvae were collected only from cold brooks and intermittent spring seepages - all in Nova Scotia. We considered identification of collected larvae to species to be speculative. Using Ross' (1944) criterion of robustness of the coxal spur, all larvae collected appear to fall to *W. shawnee* (Ross). The only adult collected keyed to *W. moestus* (Banks). This was netted at site 81 - a large main river site in the Gold River system - from which no larvae were collected. More material, both larval and adult, are required.

Collected at sites: 35, 46, 48, 51, 73, 83, 84.

Phryganeidae

88. *Banksiola crotchi* Banks

Larvae of the Phryganeidae were collected only infrequently in the riffle areas sampled. *Banksiola crotchi* was identified (using Wiggins 1960) from samples collected at a site a short distance downstream of a lake outfall. The site had a fairly extensive weedy embayment adjacent to the lotic area sampled.

Collected at site: 72.

89. *Oligostomis spp.*

Oligostomis larvae were taken occasionally from cold brooks and spring seepages - most frequently in the fall. Two species are described for eastern North America (Wiggins 1977), but the larval descriptions were unavailable.

Collected at sites: 17, 43, 46, 73, 79.

90. *Ptilostomis spp.*

The three sites at which *Ptilostomis spp.* were collected were much like those described for the *Oligostomis* collections. Again, all larvae were collected in late October - the latest collection date. Larvae of *Ptilostomis* are not separable to species at present (Wiggins 1977).

Collected at sites: 35, 46, 49.

Polycentropidae

91. *Neureclipsis spp.*

Neureclipsis larvae are characterized in Wiggins (1977). Most of the larvae inspected had stout ventral bristles on the 9th segment, but also had shorter, slender setae in that position. Two or three larvae lacked setation in this position, but had two or three extra setae ventrolaterally on the 9th segment. Adults of both sexes keying to *N. crepuscularis* (Walker) (Ross 1944) were collected from sites 2 and 24, while females tentatively identified as *N. bimaculatus* (L.) were collected at sites 24 and 74. *Neureclipsis* larvae were collected at most sites on small to large rivers in all three stream systems.

Collected at sites: 2, 4, 5, 10, 12, 15, 16, 20, 21, 24, 25, 33, 34, 37, 38, 39, 41, 42, 47, 49, 52, 74, 76, 77, 78, 80, 81, 82, 83.

92. *Nyctiophylax spp.*

Larvae of *Nyctiophylax spp.* were collected at several sites, ranging from medium-sized brooks to large rivers. They customarily occupy areas of reduced current (Wiggins 1977). *Nyctiophylax moestus* Banks was identified at several sites from Flint (1964) - all cool brooks. While unidentifiable larvae were collected elsewhere. One larva from site 52 was tentatively identified as *N. nephophilus* Flint. Adult males of *N. moestus* were collected at site 16, and a male identified as *N. celta* Denning was collected in another study on the Westfield River.

Collected at sites: *N.* moestus: 31, 40, 43, 48, 78, 82.
N. spp.: 2, 20, 22, 31, 37, 41, 48, 52.

93. *Phylocentropus spp.*

Only one *Phylocentropus* larva was collected (at site 19 in October). Several adults were netted from vegetation during sampling. Males identified as *P. placidus* (Banks) (c.f. Ross 1944) were collected at sites 6 and 19 in July - both small brooks. A *Phylocentropus lucidus* (Hagen) male was collected at site 14 (June 26) and two unidentifiable males were collected from sites 1 and 19. *Phylocentropus* is characterized by the broad, flat tarsi on all legs (Wiggins 1977).

Collected at site: 19.

94. *Polycentropus spp.*

Polycentropus larvae were collected from almost all sites in all three stream systems, including some of the intermittent rivulets. The genus is distinguished from other Polycentropodid genera by virtue of the basal segment of the anal proleg being larger than the distal, and by the dark bands of the dorsal plate of the anal proleg (Wiggins 1977). Larvae were not identified to species. A series of adults collected at site 16 (both sexes) in July were identified as *P. cinereus* Hagen.

Collected at sites: 1, 2, 5, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 47, 48, 49, 51, 52, 72, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84.

Psychomyiidae

95. *Lype diversa* (Banks)

Lype diversa is the only species of the genus in North America. Wiggins (1977) reports its habitat to be small cool streams; however, the only larvae collected in our survey were from warmer rivers. Adults were collected at three sites in mid-July, two of which were small, cold brooks (sites 2, 3, 11). The species was not collected from either Nova Scotian stream system.

Collected at sites: 12, 22.

Rhyacophilidae

96. *Rhyacophila fuscula* (Walker)

Rhyacophila fuscula was collected from a wide variety of sites, ranging from medium-sized brooks to large rivers. This large species is characterized by the apicolateral spur on the anal prolegs, and the dark transverse bands on the head capsule; an anterior one on the anterior margin, and an irregular "W" shaped one posteriorly (Flint 1962). Pupae were collected at many sites from June until October. Adults were collected from sites 12, 21, 24 and 49, and an adult male was lab-reared from a larva collected at site 24.

Collected at sites: 1, 2, 4, 5, 9, 11, 12, 14, 15, 16, 17, 18, 20, 21, 23, 24, 25, 31, 33, 34, 36, 37, 38, 39, 41, 42, 44, 47, 49, 51, 52, 72, 74, 75, 76, 78, 79, 80, 81, 82.

97. *Rhyacophila minora* Banks

Larvae of *R. minora* have unmarked, brownish-yellow, quadrate head capsules, and numerous dark setae at the anterolateral corners of the pronotum (Flint 1962). This species and *R. manistee* both have anal prolegs with a basoventral hook, and the claw lacks ventral teeth. We collected *R. minora* from two cold brooks in the St. Croix system; larvae were collected through the summer with the largest collected in late November.

Collected at sites: 11, 19.

98. *Rhyacophila manistee* Ross

This species is similar to *R. minora*, but the larvae have dark muscle scars on the head capsule, and only one to two dark pronotal setae at the anterolateral corners (Flint 1962). The species was collected from a wide variety of sites in Nova Scotia. It cohabited some of the larger brooks with *R. carolina* and was collected at several large river sites, along with *R. fuscula*. A male adult was collected from the Westfield River, N. S. on May 18. Larvae were present from June until late fall.

Collected at sites: 24, 37, 38, 39, 41, 42, 52, 74, 76, 77, 80.

99. *Rhyacophila invaria* (Walker)

As described by Flint (1962), the larvae of this species are similar to several others. Flint's key distinguishes it from *R. vibox* by the presence of a second ventral tooth on the anal claw. In general, larvae keying to this species were found in brooks, in agreement with Flint's description of its habitat. Collection of one larva from one larger, warmer stream site (site 80) might indicate confusion with another similar species, or cross-contamination, as site 79 was sampled prior to site 80. Pupae were collected in June, as well as an adult from site 73. The species was then absent from collections until fall - possible life cycle adaptation to summer drought, as it was collected in rivulets.

Collected at sites: 3, 6, 9, 11, 32, 35, 36, 38, 40, 43, 44, 45, 48, 51, 73, 75, 78, 79, 80, 83, 84.

100. *Rhyacophila carolina* Banks

Rhyacophila carolina is one of a number of species with larvae lacking apicolateral spurs and basoventral hooks on the anal prolegs, the stem of which lacks ventral teeth (Flint 1962). The head capsule is concolorous yellow. We collected larvae identified as this species in medium-sized to large brooks. Adults keying to this species (Schmid 1981) were collected from site 2 in July and October, while pupae were collected from several sites from May until August.

Collected at sites: 2, 5, 14, 15, 19, 31, 35, 36, 38, 42, 44, 82.

101. *Rhyacophila glaberrima* Ulmer

One specimen of *R. glaberrima* was collected in late August from a small, cold, very acidic brook which tumbled off a rocky hillside. The streambed was covered with mosses and liverworts. Water flow had nearly completely stopped when the collection was made. The head capsule is yellowish-brown, with slightly darker pigmentation dorsomedially, and some lighter muscle scars (Flint 1962).

Collected at site: 75.

Sericostomatidae

102. *Agarodes spp.*

Agarodes larvae are distinctive in the possession of a dorsolateral ridge over the eye, and the extension of the anterolateral corners of the pronotum into sharp points (Wiggins 1977). We collected *Agarodes* larvae in many of the larger stream sites - usually absent from brooks. One *A. (Psiloneura) distincta* Ulmer adult was reared in the lab from a larva collected at site 25.

Collected at sites: 1, 2, 4, 5, 10, 25, 33, 49, 52, 74, 77, 78, 80.

DISCUSSION

Peterson (1989) distinguished four groups based upon geographic distribution: 1) those taxa common in the St. Croix system but rarely collected from the acidic stream systems; 2) taxa present in the St. Croix system but not collected from either Nova Scotian system; 3) taxa abundant in all three systems; and 4) taxa more widely distributed in the acidic stream systems. A fifth group would be represented by taxa present in the Nova Scotian stream systems, but not collected from the St. Croix. This last group had no representative taxa in the mayflies identified.

It was simpler to categorize the Plecopteran taxa as described above than was the case with the more diverse Trichoptera - many taxa of which were collected rarely from only one or two sites. Stonefly taxa appearing to fit into the first group are primarily some of the large Perlidae species (*Phasnagophora capitata, Acroneuria lycorias, A. abnormis*, and *Paragnetina media*). *Alloperla spp.* also may belong here.

Stonefly taxa which fall into the second group are *Isoperla holichlora, Paragnetina immarginata, Pteronarcys biloba*, and *Isogenus spp.*

Stonefly taxa in group 3 will not be listed, but include many of the filipalpian taxa - Leuctra and Nemoura species.

Perlesta placida appeared to fall into group 4 - much more frequently encountered in the Nova Scotian stream systems.

Four stonefly taxa were collected from the Nova Scotian stream systems, but not the St. Croix: *Ostrocerca albidipennis, Leuctra sibleyi, Parcapnia sp.* and *Allocapnia sp.*

Trichopteran taxa which fit into group 1 include the *Agapetus spp.* and *Hydropsyche morosa*, possibly *Dolophilodes distinctus, Frenesia difficilis*, and *Psilotreta indecisa.*

Trichopteran taxa collected from at least several sites in the St. Croix system, but not at all in Nova Scotia (group 2) included *Micrasema charonis, Hydropsyche scalaris, Hydropsyche alhedra, Hydropsyche slossonae, Macronema zebratum, Hydroptila sp. 3, Neotrichia sp., Ceraclea tarsipuncta*, and *Neophylax fuscus.*

Trichoptera collected at several sites in Nova Scotia, but not in the St. Croix system, included *Hydroptila acadia* (?) and *Wormaldia sp.*, while taxa collected at considerably more sites in Nova Scotia included *Diplectrona modesta, Hydroptila xoncla* (?), *H. delineata* (?) and *Rhyacophila manistee.*

Several species, such as *Hydropsyche betteni* and *Hydropsyche sparna* were collected frequently in all three stream systems.

The failure to collect a species can never be conclusive indication of its absence, particularly so for species collected only infrequently anywhere. However, many of the species listed above in group 2 were collected regularly at several St. Croix sites, and were never collected at apparently suitable sites in Nova Scotia. The two most obvious differences between the St. Croix and the Nova Scotian systems are geography and acidity. If a species is apparently absent from Nova Scotia, it may be due to the fact that it is spreading into the Maritimes from the west and has not penetrated to Nova Scotia. Alternatively, stream pH of the Medway and/or Gold systems may prevent its successful colonization. The absence of a particular taxon due to temporary extinction of local populations along the lines of the MacArthur-Wilson hypothesis seems to me a possibility explaining possible absence from specific sites - but a less satisfactory explanation for failure to find a species in a fairly extensive drainage system. Thus,

apparent absence from a greater number of apparently suitable sites, as opposed to total failure to find a species, may reflect increased tendency for the particular taxon to disappear from these sites, either through biotic or environmental factors.

The presence of certain taxa in the Nova Scotian streams, but absence from the St. Croix drainage, may reflect either specific adaptation to low pH resulting in enhanced survival, or may reflect a different mode of invasion into the Maritimes such that colonization first occurred in Nova Scotia. This may have occurred through radiation from refugia to the south during the last glaciation or possibly some event such as wind-blown entry into Nova Scotia.

Apparent more widespread occurrence in the acidic stream systems again may reflect adaptation of the taxon under consideration to low optimal pH levels (or some other physicochemical concomitant of these acidic streams). Alternatively, the loss of possible competitors due to inability to survive in these stream systems may result in radiation of the taxon into additional sites.

A considerable number of the taxa identified may represent range extensions for that taxon. In some instances, the extension may be trivial as with filling in "holes" within a known distributional range. In other cases, known distributions may not have been noted, either through omission of proper references, or lack of publication. Given these caveats, the collection of the following species may result in extension of known geographic distribution: *Leuctra truncata*, *Isoperla holochlora*, *Culoptila cantha*, *Hydropsyche betteni*, *Hydropsyche scalaris*, *Hydropsyche morosa*, *Hydropsyche alternans*, *Hydroptila xoncla* (?), *Hydroptila hamata*, *Oxyethira grisea*, *Palaeagapetus celsus*, *C. annulicornis*, *C. diluta* (?), *C. resurgens* (?), *Oecetis persimilis*, *Triaenodes injusta*, *Glossosoma nigrior*, *Nyctiophylax celta*, *Rhyacophila carolina*, *Rhyacophila manistee*, *Brachycentrus numerosus*.

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Appendix 1. Latitudes and longitudes of the various sites sampled on the three stream systems.

St. Croix (N.B.)			Medway (N.S.)			Gold (N.S.)		
Site no.	Lat.	Long.	Site no.	Lat.	Long.	Site no.	Lat.	Long.
1	45°42'	67°30'	31	44°28'	65°02'	72	44°49'	64°30'
2	45 44	67 30	32	44 27	65 06	73	44 50	64 30
3	45 47	67 28	33	44 28	65 04	74	44 48	64 26
4	45 37	67 26	34	44 32	65 07	75	44 47	64 23
5	45 47	67 36	35	44 29	65 05	76	44 45	64 27
6	45 32	67 24	36	44 24	65 04	77	44 45	64 27
7	45 31	67 20	37	44 24	65 01	78	44 44	64 30
9	45 22	67 23	38	44 28	64 56	79	44 42	64 26
10	45 22	67 23	39	44 26	64 52	80	44 43	64 27
11	45 43	67 32	40	44 19	64 46	81	44 34	64 19
12	45 23	67 21	41	44 20	64 57	82	44 35	64 22
14	45 14	67 12	42	44 10	64 39	83	44 43	64 28
15	45 17	67 08	43	44 27	64 50	84	44 35	64 21
16	45 15	67 08	44	44 15	64 50			
17	45 15	67 09	45	44 13	64 51			
18	45 15	67 09	46	44 08	64 39			
19	45 12	67 21	47	44 10	64 40			
20	45 11	67 22	48	44 09	64 40			
21	45 17	67 17	49	44 12	64 42			
22	45 20	67 26	51	44 15	64 49			
23	45 53	67 31	52	44 14	64 49			
24	45 34	67 26						
25	45 28	67 29						

Appendix 2. Illustrations and brief descriptions of the various study sites.

A. Saint Croix System

Site 1. Palfrey Stream. Small river, site was about 1 km above entry into Palfrey Lake. Fairly open, alder-lined. No habitation upstream, but much of drainage area has been recently logged. Some mats of macrophytic vegetation, such as Potamogeton, occurred in still areas and invaded edges of riffles.

Site 2. Palfrey Stream. About 2.5 km upstream of site 1. Large brook, almost completely canopied with hemlock, red cedar, white spruce, yellow and white birch. Large boulders, many moss-covered. One hundred m downstream of a long dead-water stretch.

Site 3. Unnamed. Spring-fed rivulet which occasionally failed in dry summers. Partly subterranean. Completely canopied with white spruce and red maple. Crossed by logging road 30 m upstream of sampling site.

Site 4. Medium river with riffle area sampling site ca. 1 km downstream of First Lake. Riffle graded into extensive dead water flowing into Spednik Lake. Almost entirely open, bordered by sedges and red maple.

Site 5. Outlet of 3rd Eel Lake. Large, fairly warm brook. Mostly canopied with white spruce, balsam fir, red maple. Moss-covered boulders in more steeply graded sections. Approximately 2 km downstream of 3rd Eel Lake.

Site 6. Trout Brook. Small, cool brook. Channelized during road construction, and completely canopied with alders. Intermittent in mid-summer.

Site 7. Tributary to Canoose River. Just downstream from a main highway. Riffle area of limited extent between beaver flowages. Fairly open, surrounded by sedges and alder. Depauperate benthic populations.

Site 9. Green Brown Brook. Medium-sized brook with somewhat warmer mean summer temperatures than typical. Beaver flowages were situated several km upstream. Almost totally canopied with alder and red maple.

Site 10. Canoose River. Medium-sized river, about 7 km downstream of Canoose Lake. Uncanopied and lined with typical streamside vegetation (alders, red maple, balsam fir, etc.). Two houses or fishing camps along the river several km upstream of the sampling site.

Site 11. East Brook Lake Tributary. Small, cold brook, canopied with mature red maple and yellow birch. Had several reaches of moss-covered granitic ledge rock.

Site 12. Canoose River upstream of Canoose Lake. Small river, partly canopied with alder, red maple. Warm stream, ca. 3 km downstream from a shallow flowage.

Site 14. Gallop Stream. Large, cool brook mostly canopied with mature hardwoods.

Site 15. West Brook, Waweig River. Large brook, partially covered with typical canopy. Very steep grade over ledge rock in several sections. Large farm on west bank.

Site 16. Waweig River. Small river, fairly open, with alders lining the stream in flood plain areas. Much of the riffle area is of shale composition. A dwelling on west bank just above sampling site.

Site 17. West Brook, Pout Brook. Small, cool brook. Fully canopied with alder, red maple, balsam fir.

Site 18. Pout Brook. Medium-sized, cool brook. Almost totally canopied with typical vegetation.

Site 19. Tributary of Mohannes Stream. Small, spring-fed brook with good flow throughout the summer. Totally canopied with many mossy boulders.

Site 20. Mohannes River (not illustrated). Small, warm river with sampling site bracketed by flowages. Partially canopied with typical forest vegetation. Sampling site just downstream of a road bridge.

Site 21. Dennis Stream. Small, warm river. Sampling site 50 m downstream from outflow of a shallow, warm lake; uncanopied.

Site 22. Saint Croix River (not illustrated). Large river with site 22 the most downstream site sampled. Uncanopied, but lined with typical flood plain vegetation - red maple, alder thickets, yellow birch and (dead) American elm. No habitation, except for occasional fishing camps along the Saint Croix River upstream of the site.

Site 23. Dead Brook. Large brook with most northern latitude of any study site. The brook was almost totally canopied. Two houses on west bank at study site. The stream above the sampling site had been somewhat modified by local inhabitants (rock dams).

Site 24. Saint Croix River (not illustrated). The most upstream site on the main stem of the Saint Croix River, ca. 1 km downstream from Spednick Lake, which has numerous cottages. No canopy, with most stream-side vegetation cleared away.

Site 25. Saint Croix River at Gravel Island. Large river, 30 km downstream of site 24 and 25 km upstream of site 22.

B. Medway System

Site 31. Moose Pit Brook. Medium-sized, cool, acid brook which entered Tupper Lake 50 m below sampling site. Totally canopied with fir-maple-birch. Many large mossy boulders.

Site 32. Mount Merrit Brook. A medium-sized, relatively warm brook. Nearly totally canopied.

Site 33. Medway River. Medium-sized river with little canopy. Sampling site ca. 50 m downstream of highway bridge.

Site 34. Medway River. Just below outflow of Medway Lake. The illustration does not give an adequate impression of the steepness of the grade. Uncanopied stream lined with grasses and shrubbery. Some boulders were algal covered.

Site 35. Unnamed. Small, cold brook, totally canopied - mostly spruce and balsam fir. Many mossy boulders.

Site 36. Harmony Brook. Medium-sized, relatively warm brook. About 500 m below outfall of Harmony Lake. Canopied with hardwoods.

Site 37. Medway River below McGowan Lake. Large river lined with typical forest (principally red maple, white pine).

Site 38. Halfway Brook. Medium-sized, cool brook. Totally canopied, principally with red maple and balsam fir.

Site 39. Pleasant River. Medium-sized river. Unpaved road runs along west bank along sampling area. Partially canopied with maples.

Site 40. Beavertail Lake Brook. Small brook with beaver dam 200 m above sampling site. Completely canopied.

Site 41. Outlet of First Christopher Lake. Medium-sized river, a short riffle stretch between lakes, partially canopied with maple.

Site 42. Limestone Brook. A large brook with hardwood canopy for most of its length. Some of the sampling site had been cleared and mown.

Site 43. Keddy Brook. A small brook which flowed through a cow pasture upstream of the study site where it was alder-lined. The sediments appeared to have a high organic matter content. Perhaps because it ran through a meadow, it was warmed up during the day to a greater extent than other brooks of similar size.

Site 44. Fifteen Mile Brook. A medium-sized cool brook with a full canopy of mature hardwoods and pine. The reach sampled was limed subsequent to our sampling.

Site 45. Twelve Mile Brook. Roughly the same size as site 44, but drains a shallow flowage, so that it tends to be somewhat warmer. Nearly fully canopied.

Site 46. Unnamed rivulet. A roadside channelized spring seepage with abundant moss growth. Intermittent in mid-summer. Most of the "rivulet" was rather sluggish. Canopied with growth of young poplar.

Site 47. Medway River. The most downstream site sampled, in the town of Mill Village. Large river, tree-lined for the most part. Many rock ledges and falls in this part of the river.

Site 48. Tumblingdown Brook. A tributary to the Medway at Mill Village. Although tree-lined, the riparian strip is fairly narrow near the sampling site, with lawns flanking it. A medium-sized, cool brook.

Site 49. Wentworth Brook. A large brook which flows out of a deadwater just upstream of the sampling site. As obvious in the illustration, a lot of macrophytic vegetation was present.

Site 51. Buggyhole Brook. A small, cool brook emptying into the Medway just downstream of site 52. Drains out of Cow Moose Lake ca. 4 km above sampling site. Well canopied with mature maples.

Site 52. Medway River. The main stem of the Medway at Bangs Falls, ca. 8 km below the outlet of Ponhook Lake and the town of Greenfield. Many fishing cottages along the east bank between Greenfield and the sampling site.

C. Gold System

Site 72. Outlet of Seffern's Lake. A medium-sized brook. A short stretch of riffle area exists 50-100 m downstream of the lake outlet in an otherwise sluggish stream. The brook forms the highway ditch for a short distance before turning away into an alder tangle.

Site 73. Hatchard Brook (not shown). A small, cold brook, apparently fed with spring seepages in large degree. The site of highest pH of the Nova Scotian sites. Rocks covered with mosses and liverworts.

Site 74. Outlet of Wallubec Lake. A small river with the sampling site about 200 m below the lake outfall, just below a highway bridge. Many houses nearby, although trees lined the entire stretch.

Site 75. Rocky Brook. Aptly named; a small, cold brook tumbling off a steep rocky hillside canopied with mature hardwoods. The most acidic site sampled. Nearly intermittent in dry summers.

Site 76. Mill Brook. A large brook draining a small lake (Horseshoe Lake) about 1 km above the sampling site, which was below a highway bridge. The brook was fully canopied with hardwoods, but the underbrush had been cleared by local inhabitants.

Site 77. Gold River at New Ross. Just downstream of the confluence of the Gold River and Mill Brook. A medium-sized river with a short stretch of riffle (where river narrows into the background).

Site 78. Larder River. A small river lined with alders from the sampling site to the outfall of Lake Ramsey, 1 km upstream. Surrounded by farms.

Site 79. Cobbler Brook. A small, cold, acidic brook canopied mainly by evergreens and alders. Many large, moss-covered boulders.

Site 80. Gold River. Just below Lawson Lake, about 2 km below site 77. Uncanopied, and the sampling site was under a large highway bridge.

Site 81. Gold River, about 2-3 km above head of tide. A large river, tree-lined with mainly hardwoods, but area is well settled - near the town of Chester Basin.

Site 82. Unnamed. Medium-sized, cool brook, alder-lined.

Site 83. Bench Brook. A small, cold brook, shaded with alder thickets.

Site 84. Unnamed. An intermittent spring rivulet, partly subterranean, which drains into a roadside ditch. Rocks covered by mosses and algae.

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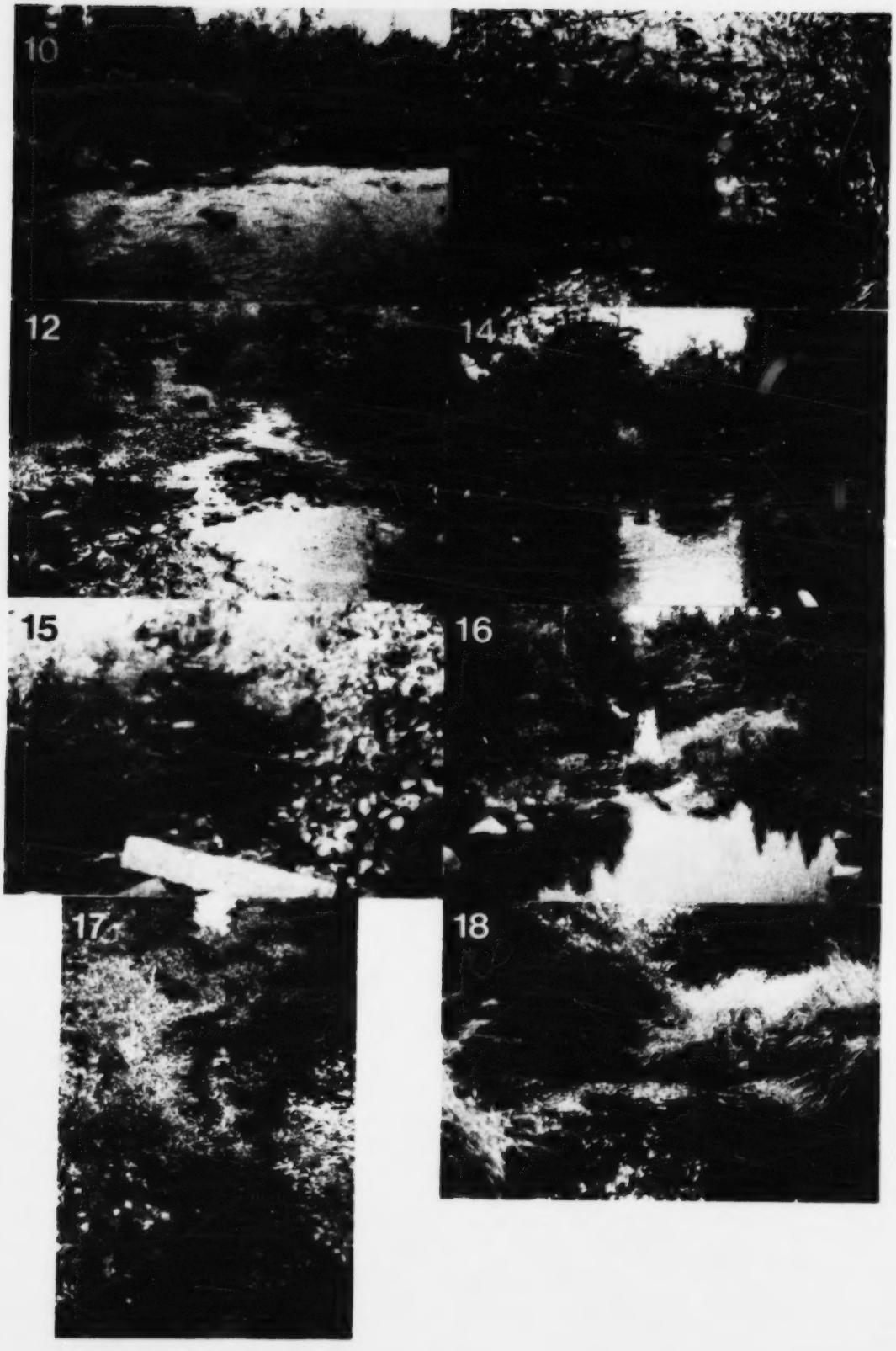
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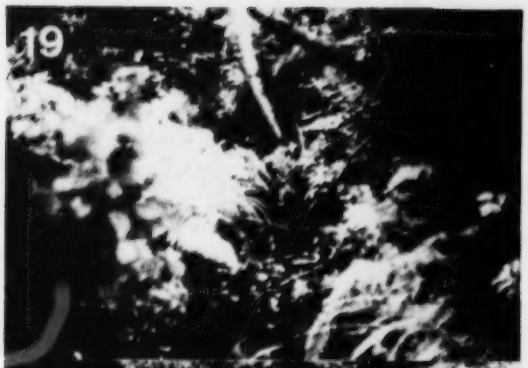
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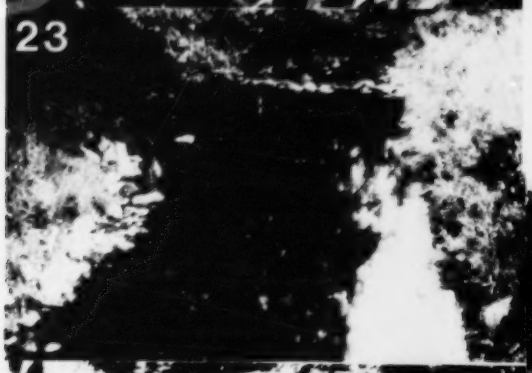
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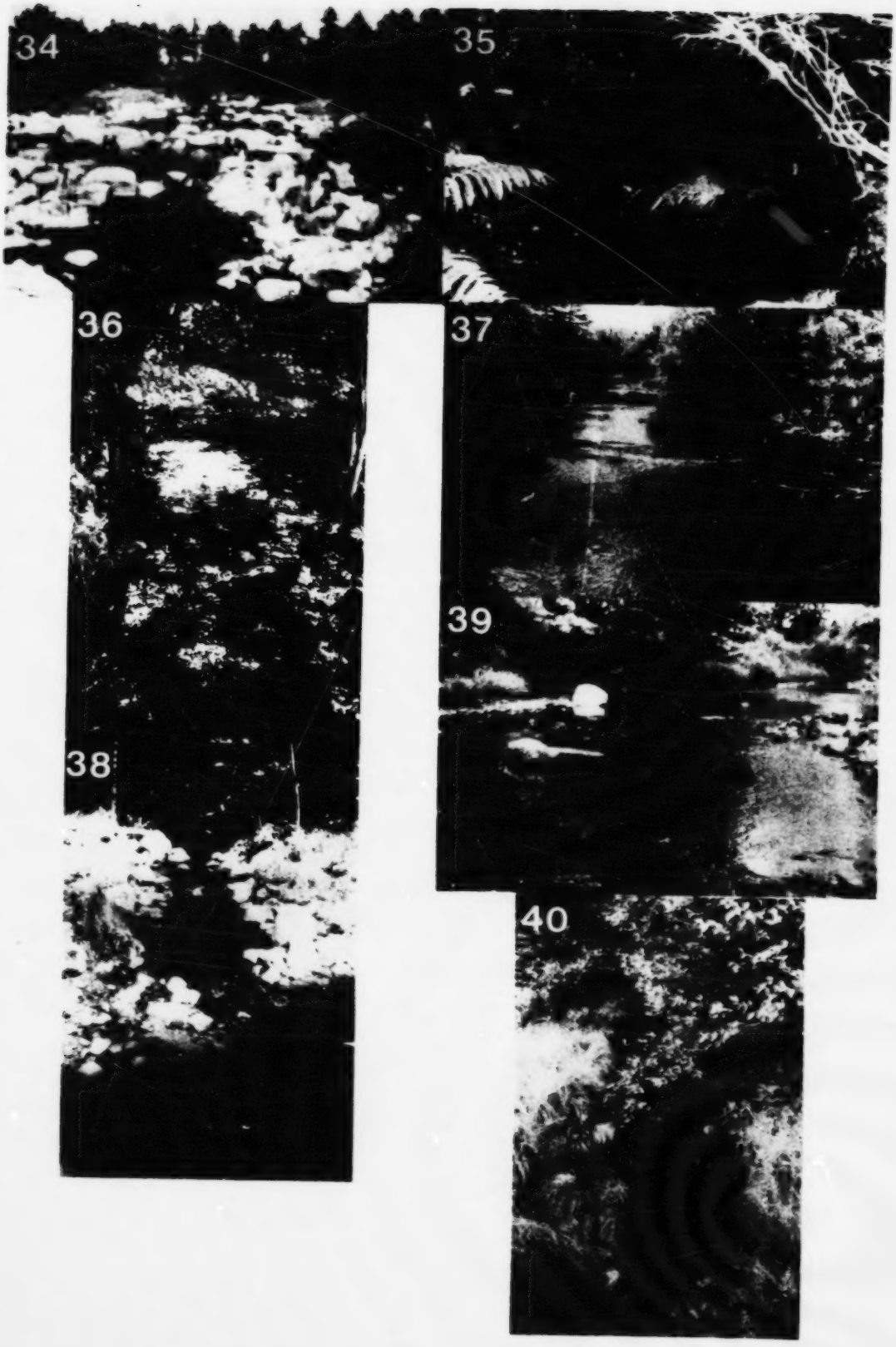
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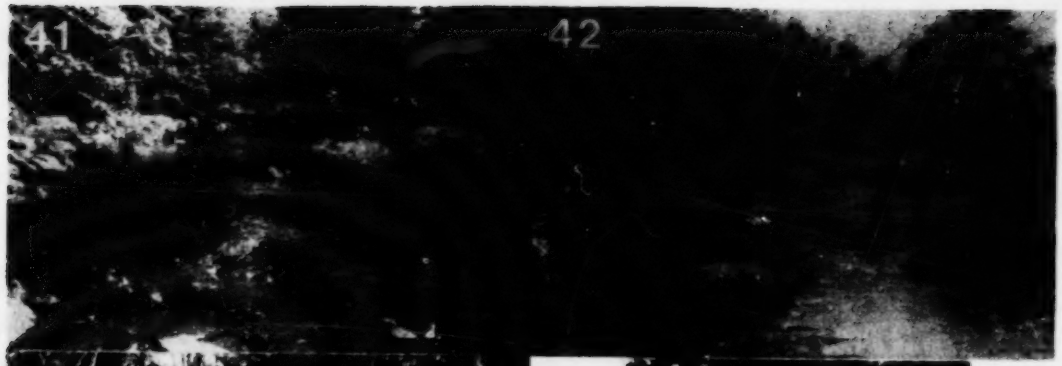
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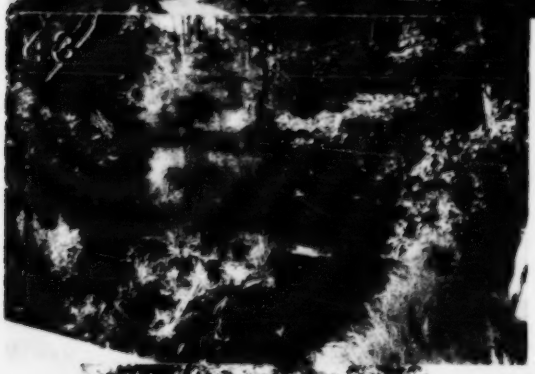
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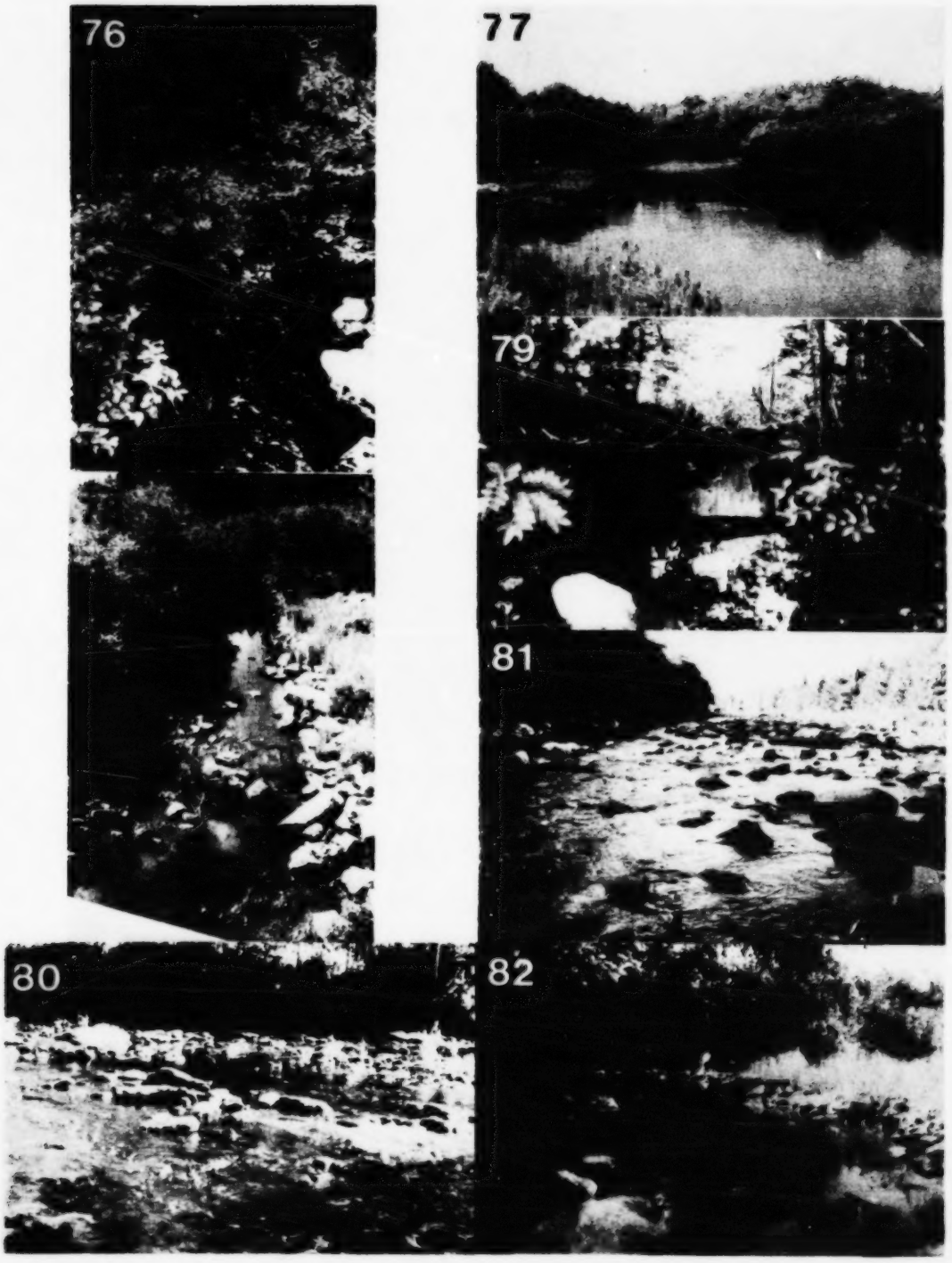
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